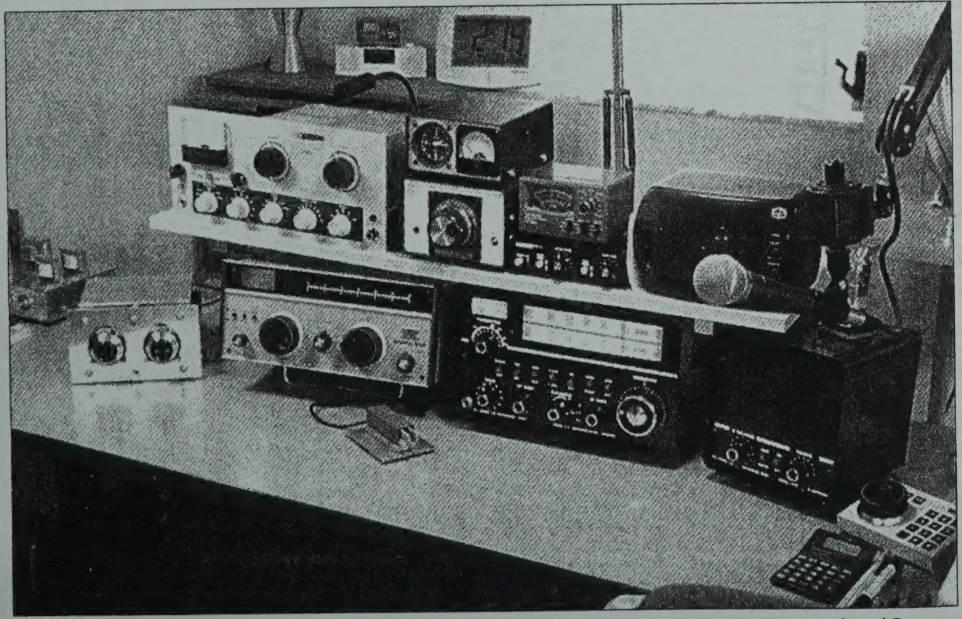
Drake 2-B...One More Time

By Richard Lucas, K4JEJ
6065 Felter St.
Jupiter, FL 33458

A vague memory is what started this article, and somehow it turned into reality with a happy ending. Back in the '60s I bought my first Drake 2-B receiver and used it on CW and SSB. After a string of S-40-like receivers the 2-B was a real treat, and I remember being quite impressed and pleased with it. And having owned many other radios since then, I got to wondering just how good those memories really were.

So when I had a recent opportunity to buy a like new 2-B I jumped at it. Well, I'm happy to report that those memories and the radio held up very well. There is just something about the 2-B/2-BQ combination and the way it sounds on CW that just has not been replicated by any modern state-of-the-art devices. The only real "problem" for a CW guy like me is that of monitoring my own transmitter. Like any receiver, the Drake is overloaded by a co-located transmitter, such as my Heathkit DX-60...another story in itself.

Anyway it was time then to "tame" the 2-B. I cured the problem from several angles, none of which are difficult to duplicate. All it takes is a willingness to make it happen and a couple of hours spent doing it. First, I built an antenna changeover relay for the DX-60 that not only switches the antenna between receiver and transmitter, but it also grounds the receiver antenna input in the transmit position, thereby reducing the RF input to the 2-B. It takes a relay with DPDT contacts. A Radio Shack 275-249



This is my present station with a Drake 2-B receiver, 2-BQ speaker/Q-multiplier, and a Heathkit DX-60 transmitter on the top shelf.

works well.

Next I set out to limit the signal in the 2-B to a ceiling point, well above any received signal, but low enough to chop my transmitter signal before it got detected and the AGC took over. Hence an ultra-simple diode clipper was installed on the signal-input grid of the product detector. I simply soldered two back-to-back 1N914's from pin #7 to ground on V7, the 6BE6 product detector.

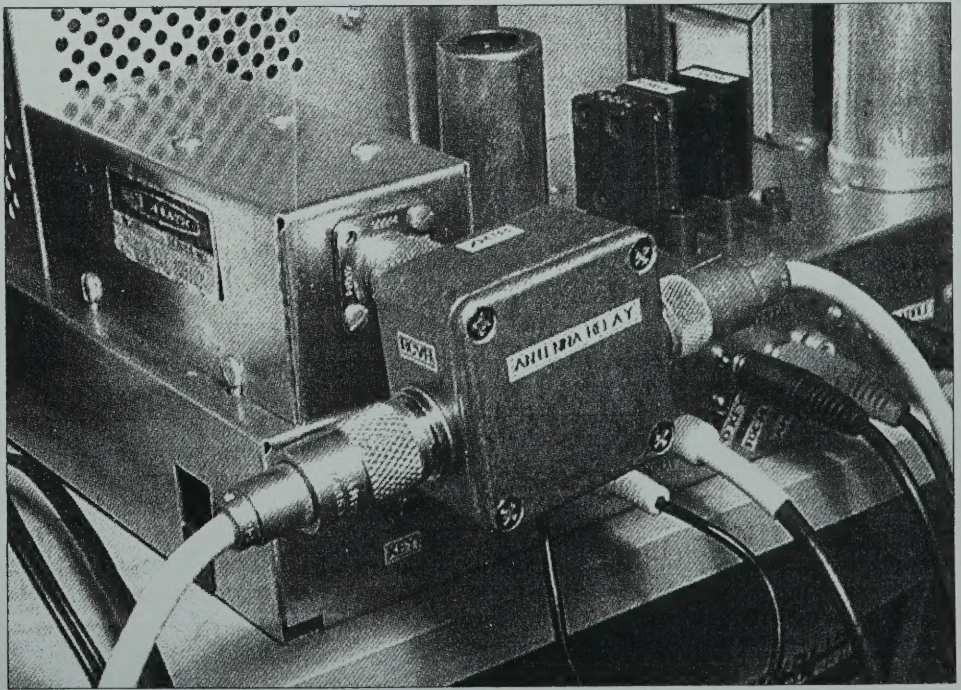
These two changes were enough to bring the transmitted CW signal to very-near the same volume as received signals with no unwanted byproducts. A very pleasing situation! The slow AGC, however was still a bit sluggish on recovery from the transmit mode...enter the mute mod.

I decided that instead of leaving the receiver totally unmuted on transmit; there must be a way to gate it on just enough to hear the transmitter. Again, a simple fix was found: I installed a zener diode between the "mute" terminal on the rear of the 2-B and ground, cathode to mute, anode to ground. Don't forget to switch the STBY/RCV switch to STBY. A string of reverse-connected 1N914's would have worked as well.

This change will open up the receiver gain (on transmit) to about 30-db over S-9, just enough to provide you with a really good transmit monitor. Then, on the switch back to receive the 2-B is instantly returned to full RF gain. I used a 1N4734, a ½ watt, 5.6-volt zener. The monitor gives you the real story: the drifting VFO, chirps, clicks-anything that's coming out of the transmitter is heard at full-volume, in sharp, clear sine wave form.

These simple changes were all that was needed to make the 2-B into a first-rate CW receiver and companion to the DX-60 or any transmitter like it. Zener diodes and 1N914's weren't around when the 2-B was new, but it doesn't seem to object to their presence now. It's a keeper.

ER



This is a close-up of my homebrew antenna relay that is mounted on the DX-60.

T4/T4X/T4XB/T4XC Modification to use <u>6AQ8</u> to replace <u>6EV7</u>.

6AQ8 filament current is lower thus causing imbalance in filament voltage on 12AX7. It is necessary to add a 47 ohm 2 watt resistor between pins 4 and 5 of V-10.

TR3/TR4/TR4C/TR4Cw

No circuit change is required, simply switch tubes.

Improved tuning on 160 meters with the T-4X transmitters

When using either a T-4XB or T-4XC transmitter below 1850 kHz, a true dip could never be obtained and loading was difficult, even when using a 50-ohm dummy load. Through discussions with other Drake owners, I found that this frustrating problem was shared by other T-4X-series transmitter owners. Being curious about this strange behaviour, we called Drake only to find that their low-end cutoff frequency is 1840 kHz. With this news, we decided to optimize the output network for the 1800-1850 kHz band, since that's all we have in New England. The modifications are almost trivial, requiring only two capacitors in the output network and a third for the driver tank circuit, but the results are excellent. The transmitter can be loaded and controlled on the low end of 160 just the same as on any other band.

As shown in **fig. 3**, the modification to the output network requires the addition of a capacitor on each side of the pi network. The part numbers in parentheses apply to the T-4XC; the others, to the T-4XB. Using the pictorials provided in the Drake manual, locate S4H and C65 (C86). Add a 120-pF, 2000-volt capacitor in parallel with C65 (C86). Next, locate C67 (C89), an 865-pF capacitor on S4G, and add a 680-pF capacitor in parallel.

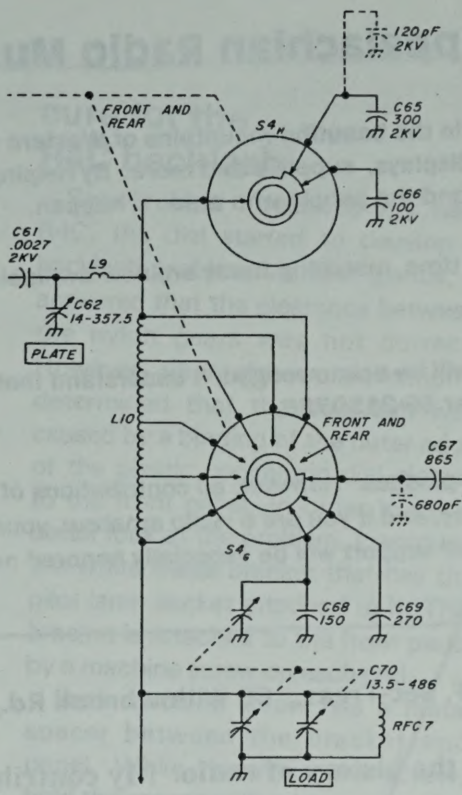


fig. 2. Schematic diagram of the changes made to the pi network to enable it to cover the low end of 160 meters. The numbers in parentheses refer to the components in the T4XC. The first designation is for the T4XB.

In addition to the output pi network, the driver tank circuit also required padding, since the driver control had to be rotated fully counterclockwise. This modification is depicted in **fig. 4**. A 36-pF capacitor was connected in parallel with C39 (C54), located on the rear of S4F.

With the implementation of these simple and inexpensive modifications, our Drake transmitters will load very nicely in the 1800-1840 kHz region, with the driver control showing a nice peak rather than being fully against the stop.

Steven E. Holzman, W1IBI
John D. Adamson, W1HZH

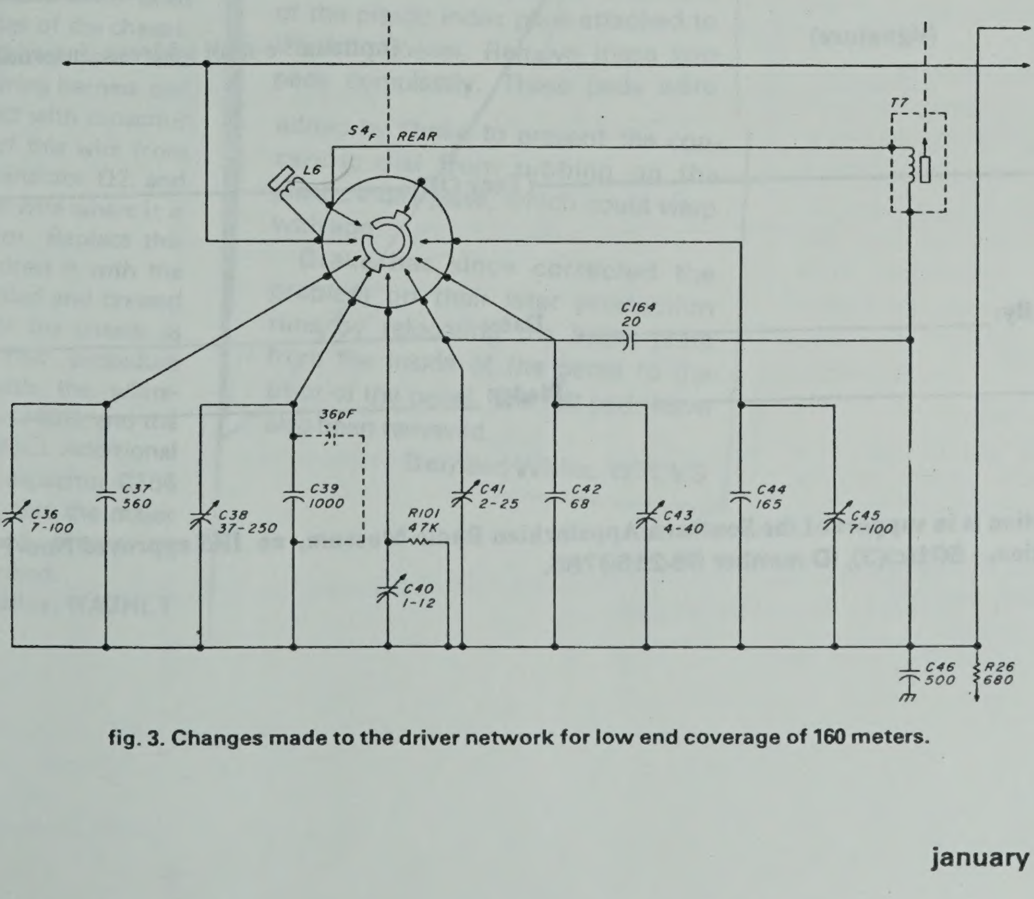


fig. 3. Changes made to the driver network for low end coverage of 160 meters.

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Drake R4-C modification

At low listening levels, when using headphones or speaker with the Drake R4-C receiver, the audio is noticeably contaminated with power supply ripple. This may be corrected by a remarkably simple modification which will become obvious after examination of the chassis layout.

In order to connect the diode and regulator board located near the rear of the chassis with the filter capacitors located near the front of the chassis, connecting wires have been run in a circuitous manner alongside the audio cables and through the wiring harness. Return currents to the power transformer center taps travel through the chassis underneath the audio board ground connections.

To re-route these ground currents, simply clip the red-yellow transformer lead from the grounded tie-point at the rear of the chassis and, by splicing in another piece of wire, connect it to a ground lug of filter capacitor C163. In a similar manner, move the blue-yellow transformer lead to a ground lug of filter capacitor C166, and dress both wires along the inner edge of the chassis. Next, locate the white-purple lead which goes into the wiring harness and emerges again to connect with capacitor C166 Δ, clip one end of this wire from the base of regulator transistor Q2, and clip the other end of the wire where it is fastened to the capacitor. Replace this wire with another and dress it with the two wires already installed and dressed along the inside edge of the chassis as previously described. This procedure should be repeated with the white-orange lead to capacitor C166D, and the white-yellow lead to C163☐. Additional capacitance across filter capacitor C166 helps to a small degree, but the major improvement is obtained simply by moving the wires as described.

George R. Bailey, WA3HLT

cure for the R4C backlash

Shortly after I received my new R4C, the dial started to develop a backlash problem. At first glance, it appeared that the clearance between the nylon gears was not correct. However, upon closer examination I determined that the backlash was caused by a binding of the outer edge of the plastic concentric dial closest to the front panel. In order to get a better look at the problem, I removed the white metal bracket that has the pilot lamp socket attached to it. This bracket is attached to the front panel by a machine screw on each end.

Each machine screw has a metal spacer between the bracket and panel. While removing the screw, hold the spacer with a long-nose plier or it will fall down into the bottom of the chassis necessitating the removal of the bottom cover in order to retrieve it.

After removal of the bracket, you will notice two felt pads on each end of the plastic index plate attached to the front panel. Remove these two pads completely. These pads were added by Drake to prevent the concentric dial from rubbing on the plastic index plate, which could warp with age.

Drake has since corrected the problem on their later production runs by relocating the index plate from the inside of the panel to the front of the panel. The felt pads have also been removed.

Bernard White, W3CVS

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cleaner audio for the R-4C

The Drake R-4C offers many attractive features for the weak-signal enthusiast (excellent AGC, noise blanker, and selectable i-f filters). However, a major annoyance is the large amount of hiss in the audio. This hiss can be traced to the 50-kHz BFO feeding into the audio circuit. An effective cure is to roll off the audio response and put a filter between the product detector and the subsequent audio stages.

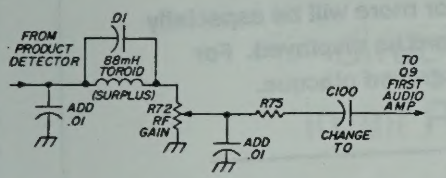

fig. 1. Schematic diagram of the changes made to the Drake R4C to eliminate the 50-kHz BFO feedthrough into the audio system.

The following simple circuit changes (see **fig. 1**) are an effective cure for the problem.

1. Change C99 to 0.1 μF

2. Connect a 0.002-μF capacitor in parallel with R83

3. Change C100 to 0.47 μF, improving the low-frequency audio response

4. Connect a 0.1-μF capacitor from the wiper of R72 to ground

5. Connect an 88-mH toroid, with a 0.01-μF capacitor in parallel, between the audio gain control and the product detector output

6. Connect a 0.01-μF capacitor across the output of the product detector

7. Replace C103 with a 0.005-μF capacitor

8. Change C175 to 100 μF

These changes will eliminate the hiss and also clear up the low-frequency distortion.

Steve Powlishen, K1FO

new product detector for the R-4C

As mentioned in a previous article,[1] the product detector in the Drake R-4B and R-4C leaves room for improvement. The present design allows the audio to leak back into the last i-f stage, from where it is detected, causing the AGC to vary at an audio rate. To correct this error we developed a reasonably simple product detector which eliminated the problems. Unfortunately, as stated in the article, the main disadvantage

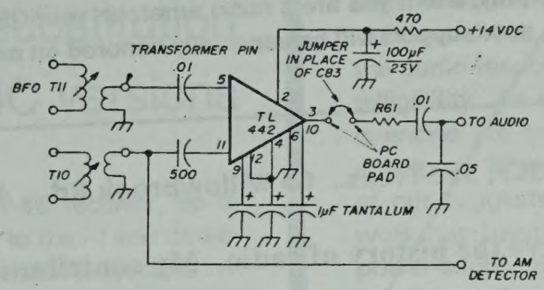

fig. 2. Schematic diagram of the TL442 product detector. All components are mounted on a 4.5 × 4.5 cm (1-3/4 × 1-3/4 inches) piece of 100-mil Vector board. The resistor and capacitor in the 14-volt line provide some additional filtering and also drop the voltage down to approximately 11.8 Vdc.

of the MC1496 was the high number of external components.

In recent correspondence with Howard Sartori, W5DA, he suggested another device which has also proved suitable as a product detector, the TL442 from Texas Instruments. As seen in **fig. 1**, the circuit is extremely simple, yet provides essentially the same performance as the MC1496.*

To begin installation, it is first necessary to remove Drake parts CR2, CR3, C83, C84, and R60. Next, the wires connecting the output of T11 and the printed circuit board are removed. The 0.01 μF coupling capacitor to be installed should connect between the transformer pins and the IC socket. There shouldn't be any connections on the circuit board for either the BFO of i-f inputs. Completing the installation only requires that the IC, socket, and associated components be mounted on a small piece of 100-mil Vector board and mounted in the same location as the MC1496 version. All other connections can be made according to **fig. 1.**

Audio output is slightly higher than a stock R-4C. The combination of R61 and the original 0.05 μF bypass capacitor provide the proper high-frequency rolloff. In this configuration, and also in the original, the product detector will accept a 20 dB increase in signal level before it overloads.

As an addendum, several people have reported an audio oscillation problem after incorporating the 0.0015 μF capacitor referred to in the original article. We've found that this can be cured by inserting a 4700-ohm resistor in series with the added capacitor and also connecting a 0.01 μF capacitor across the headphone jack.

*A parts package for this product detector is available from G. R. Whitehouse, Newbury Drive, Amherst, New Hampshire 03031.

reference

1. J. Robert Sherwood, WB0JGP and George B. Heidelman, K8RRH, "Present-Day Receivers — Some Problems and Cures," *ham radio*, December, 1977, page 10.

Rob Sherwood, WB0JGP
George Heidelman, K8RRH
Sherwood Engineering

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new audio amplifier

for the Drake R-4C

A new audio amplifier for the Drake R-4C, suitable for direct substitution in all R-4C versions

Improvements in the Drake R-4C receiver, up to now, have been confined mainly to the i-f and detector systems.[1,2,3] One remaining area which needs improvement is the audio strip, which suffers from buzz and higher-than-desirable distortion; it also dissipates 7 to 10 watts of heat near the PTO. The audio amplifier, diagramed in **fig. 1**, eliminates these problems. While intended as an R-4C retrofit, this circuit performs so well that we also recommend it for other communications uses.

Our circuit is designed around National Semiconductor's LM383T, which, with the R-4C low-voltage supply, can deliver in excess of 2 watts into a 4-ohm load. The LM383 and associated components* can be mounted on a copper-clad board 3.8 cm (1½ inches) square, or another appropriate small heatsink (for a V_{cc} of 16 volts or less). It should be installed just behind the front-panel phone jack, between the passband-tuning capacitor and long i-f shield on which the Sherwood CF-600/6 may be mounted. This location provides access to the speaker lead and detected signal at the audio gain pot. It also keeps the circuit away from power transformer hum fields in the chassis.

circuit precautions

The secret of making the LM383 an unconditionally stable audio amplifier (suitable for field installation in various layout configurations) is our output stabilization network. Proper stabilization is accomplished by connecting a 1.0-μF monolithic ceramic capacitor (such as Sprague 5CZ5U105X0050C5) with 19-mm (3/4-inch) leads directly between pins three and four of the LM383. Use of a lower-value capacitor with significantly longer *or* shorter leads will virtually guarantee oscillation problems. Tantalum or aluminum electrolytics *cannot* be substituted for the monolithic capacitor.

Other circuit values have been chosen to tailor the audio response for greatest communications intelligibility. As in the original R-4C circuit, low frequencies are rolled off at one end of the needed spectrum; high-frequency shaping is similar to that of our suggested modification.[1] The feedback network has been chosen to provide nearly 40 dB of power-supply ripple rejection, minimizing the need for abnormal amounts of filtering. Gain at 1 kHz is 40 dB.

component selection

As with any high-gain amplifier, feedback and hum loops between the input and output should be avoided. Return all signal and power leads to pin 3, except for V_{cc} bypass, which should be returned to the IC tab with a solder lug.

To reduce component size, the 0.22-μF and 10-μF capacitors can be 16-volt (or greater) tantalums. The 200-μF electrolytic at pin 2 can have a 3-volt rating. The 300-μF output capacitor should have a minimum rating equal to V_{cc} (20 volts maximum). Sixteen volts is adequate for the R-4C. As mentioned above, a small heatsink is used for a V_{cc} less than 16 volts; above 16 volts a large heatsink. Never exceed a V_{cc} of 20 volts.

installation

To disable the existing amplifier, lift the output

By J. Robert Sherwood, WBØJGP, and George B. Heidelman, K8RRH, Sherwood Engineering, Incorporated, 1268 South Ogden Street, Denver, Colorado 80210

*A parts kit will be available from G. R. Whitehouse, Newbury Drive, Amherst, New Hampshire 03031.

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transistor's collector lead at its solder lug. Also, remove its base or emitter wire, and/or disconnect one end of the driver's 100-ohm collector resistor. Connect the new amplifier's output to the phone jack terminal *with* the sleeved wire from the audio output transformer, and bypass with a 0.01-μF capacitor. This secondary is still used to provide the needed step-up for anti-vox system.

The only ground return should be a short, thick, insulated wire, run from pin 3 directly to the cable-braid terminal of the audio gain pot (rear section of

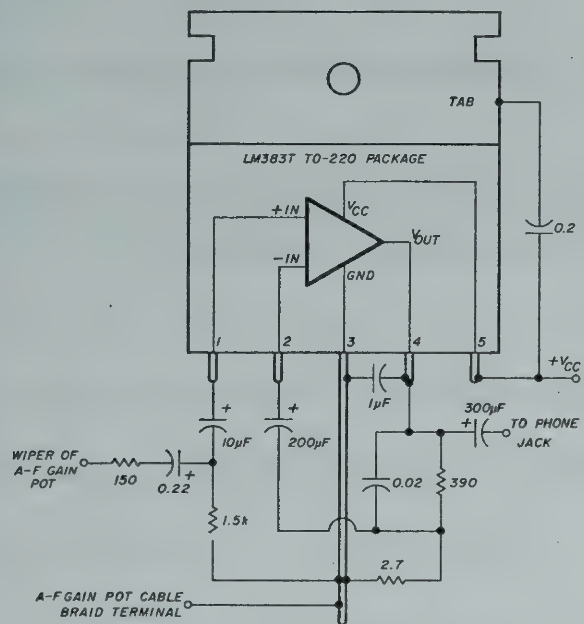

fig. 1. Schematic diagram of the new audio amplifier for the R-4C, based upon the LM383T audio amplifier IC. Resistors are ¼ watt. As pointed out in the text, all ground returns must be made through the connection to pin three to eliminate hum and feedback problems. The 1-μF monolithic ceramic capacitor *must* have 19-mm (¾-inch) leads (see text).

the dual control.) Do not allow the board or heatsink to touch any other part of the receiver ground. Next, add a small wire between the audio gain-control braid terminal and a close chassis ground. Disconnect the existing wire from the gain pot center wiper terminal, and connect the new amplifier input to this lug. Connect V_{cc} to the original audio-strip printed circuit board terminal with the blue wire from the audio-output transformer primary.

references

1. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "Present-Day Receivers — Some Problems and Cures," *ham radio*, December, 1977, page 10.
2. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "New Product Detector for the R-4C," *ham radio*, (ham notebook), October, 1978, page 94.
3. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "New Product Detector for the R-4C," *ham radio*, (short circuits), February, 1979, page 94.

ham radio

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This fine receiver
has been the target
of many design improvements:
here's another

Drake R-4C receiver
improved power supply

In keeping with our policy to provide the most recent information on updating equipment, we present this article on improvements to the popular Drake R-4C communications receiver. As author Klinman points out, the perfect receiver has yet to put in an appearance. The R-4C by Drake with its many features comes close to the perfect receiver. These modifications to the R-4C are easy to make, result in a significant operational improvement, and use a minimum of mechanical modifications to preserve resale value of the radio. Editor

The perfect communications receiver has yet to be produced. The Drake R-4C approaches this ideal. With certain modifications it can be made into a real "performance" receiver. Among these are the addition of selective first i-f filters, improved product detector and audio modifications as described by Sherwood,[1] third mixer redesign with solid-state tube replacement,* an audio lowpass filter by Sartori,[2,3,4] and agc modification by Klinman.[5] I recommend that those using the Drake R-4B/C obtain the excellent summaries of updates to these receivers available from Sherwood Engineering and Sartori Associates.†

*While the "Solid Tube," a product of Sartori Associates, used as replacement for the 6EJ7 mixers in the R-4C does effectively eliminate the severe noise generated by the vacuum tubes in these circuits, it does noticeably reduce large-signal-handling capacity of the receiver.

†Sherwood Engineering, Incorporated, 1268 South Ogden Street, Denver, Colorado 80210; Sartori Associates, P.O. Box 2085, Richardson, Texas 75080.

By Richard Klinman, W3RJ, RD 1, Flint Hill Road, Coopersburg, Pennsylvania 18036

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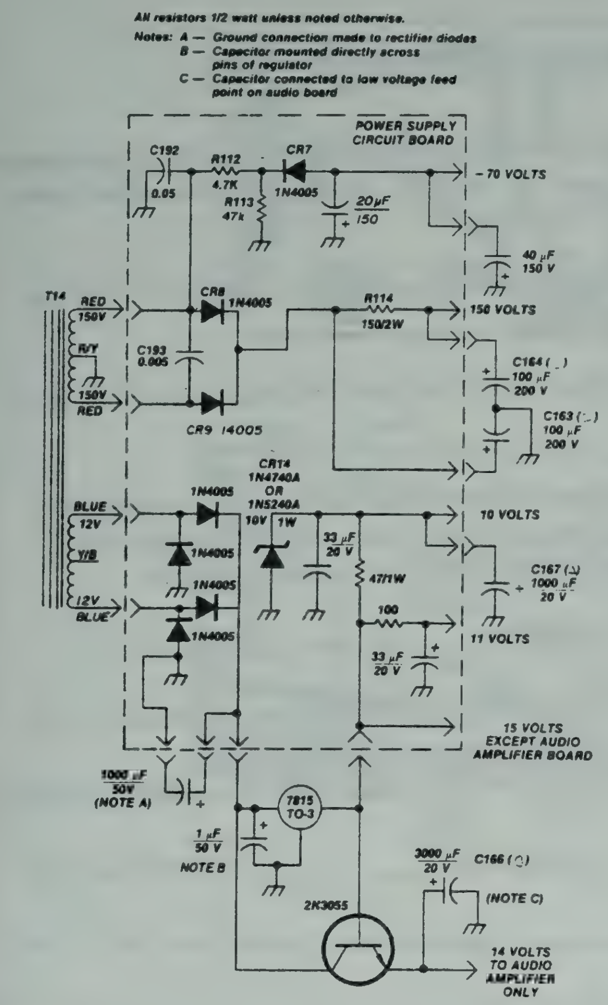
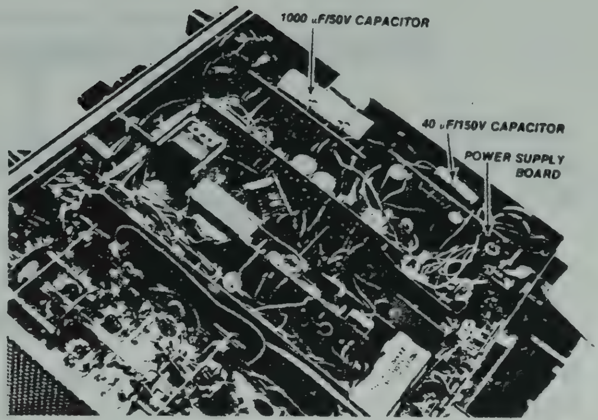


fig. 1. Schematic diagram of the Drake R-4C power supply. Numbered components refer to those in the original circuit.

A problem yet unresolved is the presence of excessive hum in the audio output. As pointed out by Sartori,[3] the original Drake power supply also generates significant heat under the R-4C chassis. In that article, Sartori described modifications to the power supply, but the suggested circuit produces marginal voltage for proper operation of the recommended monolithic voltage regulator. In addition, the circuit yields a regulated low voltage 2 volts lower than the original 14-15 volts.

Complete replacement of the R-4C audio amplifier with a monolithic audio power amplifier, as suggested by Sherwood,[6] will reduce the audio-amplifier average current drain on the low-voltage supply and



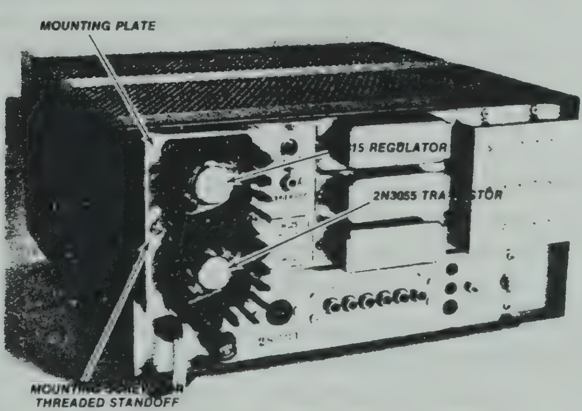
Underside of the Drake R-4C receiver chassis showing revised power-supply board and component layout.

regulator, but the monolithic circuit is difficult to stabilize and it can still require considerable peak current when driving a low-impedance load.* An advantage of the monolithic audio power amplifier is that it provides a significant amount — on the order of 30 dB — of power-supply ripple rejection.

As described here, it's a relatively simple matter to retain the original R-4C audio amplifier and upgrade the power supply.

revised power supply

Fig. 1 is the schematic diagram. A full-wave bridge rectifier with single-stage capacitor-input filter produces 25-30 volts, which is sufficient to power the 7815, a 15-volt monolithic voltage regulator. While increasing the average power dissipated by the power transformer, T14, no additional temperature rise of the transformer is noticeable. Because this supply voltage exceeds the voltage rating of the



Rear apron of the Drake R-4C receiver showing the voltage regulator and pass transistor, heat sinks, and homebrew mounting plate.

*The circuit may be stabilized by using Sherwood's output stabilization network, which is part of their audio-amplifier kit. Editor

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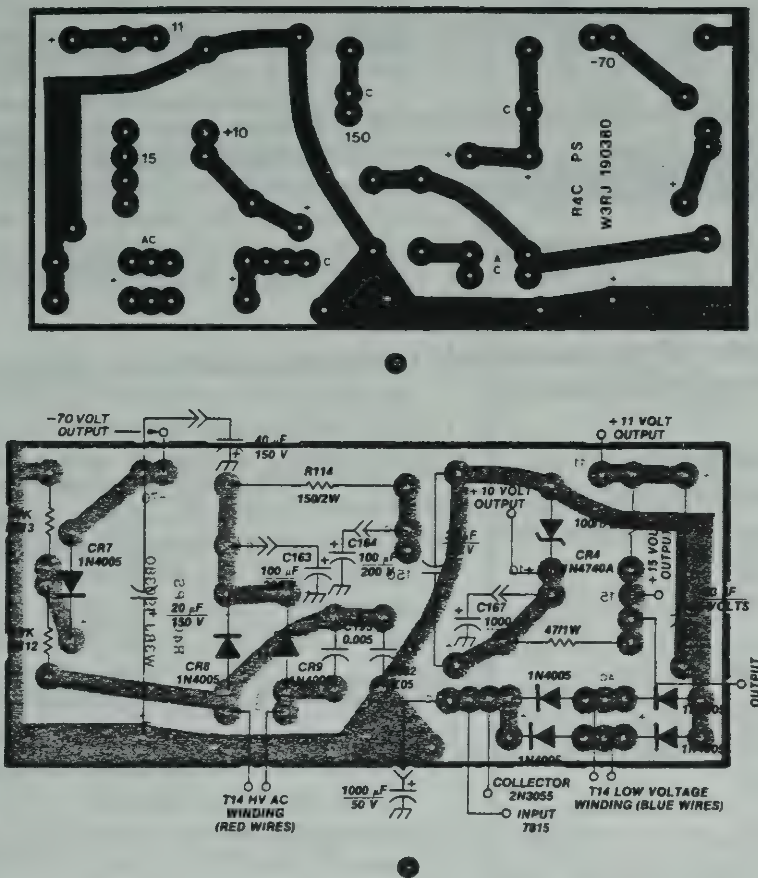

fig. 2. Circuit-board details. Full-size PC-board mask is shown in (*A*). Illustration (*B*) shows component layout.

existing filter capacitors, C166 and C167, an additional 1000 μF 50-volt electrolytic filter capacitor is required. The output of the TO-3-cased 7815 (or equivalent) 1-amp 15-volt regulator powers all 15-volt circuits *except the audio output stage*.

Power for the audio amplifier cannot be taken directly from the 7815 because of severe instability caused by the large inductive load of the audio output stage. A common base 2N3055* pass transistor provides the required isolation in addition to reducing the thermal load on the 7815 voltage regulator. One of the unused sections of the R-4C filter capacitor, C166, is used to further reduce the impedance of the 14-volt supply to the audio amplifier. A series resistor provides 11 volts for the PTO, and a zener diode provides 10 volts for the BFO and HFO circuits.

The remainder of the power supply is similar to the original circuit in the R-4C. An exception is additional filtering of the −70 volt supply to eliminate the last trace of hum in the receiver audio.

hardware

A board containing all components except the pass transistor, voltage regulator and 1-μF bypass capacitor, and the 1000-μF, 50-volt and 40-μF 150-volt filter capacitors replaces the original R-4C power supply board. The board mask and component placement are shown in **fig. 2.** Solder lugs, bent 90 degrees in the center and soldered to the board at the indicated locations, serve as mounting feet similar to those on the original board. Noteworthy details of construction are:

1. The low-voltage filter capacitor (a small size 1000-μF, 50-volt electrolytic) is mounted between the power supply or audio circuit board and the side of the chassis. It is secured to the chassis side wall with a plastic stick-on cable tie anchor. The ground lead

*Any NPN power transistor with V_{ceo} of at least 40 volts and collector current rating of 1 ampere will work in this circuit. (The 2N3055 is available for less than a dollar from several mail-order parts houses.)

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of this capacitor must be returned to the ground foil of the power-supply board. A chassis ground to the filter capacitor cans, C163 through C167, while mechanically convenient, will lead to audio hum.

2. The 40-μF, 150-volt miniature electrolytic capacitor filtering the −70 volt supply is mounted between the power-supply board and the side of the chassis. It is soldered from the −70 volt output pad to the ground on the foil side of the board and is supported by its axial leads.

3. The centertap of the low-voltage winding (yellow/blue) of the power transformer, T14, is disconnected from ground, covered with heat-shrink tubing at the end to avoid short circuits to ground, and tucked out of the way along the chassis.

4. Connection between C166 and the 14-volt supply to the audio board is made to the low voltage supply solder lug directly on the audio board. The photograph shows the new power-supply board and component layout under the chassis.

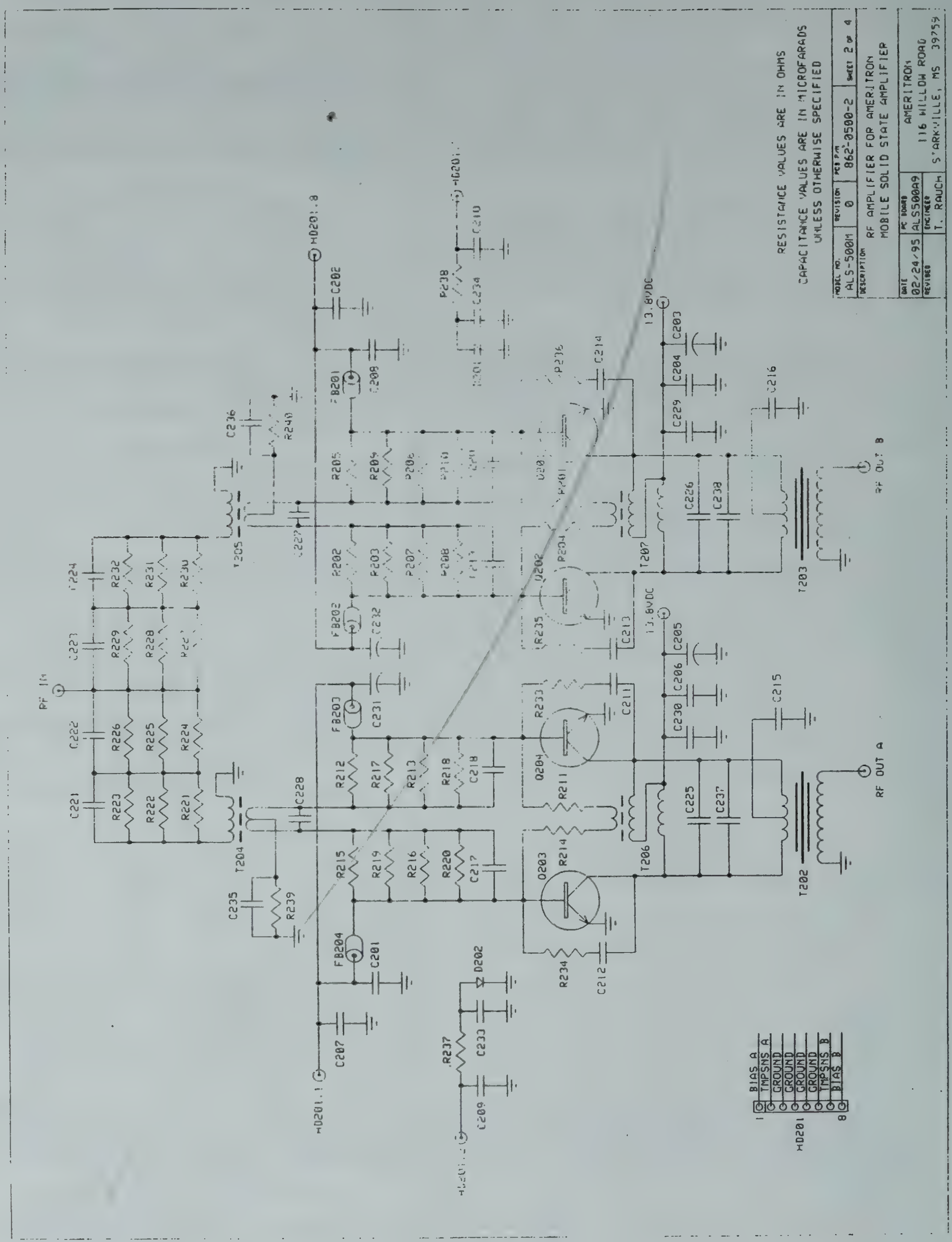
The 7815 monolithic voltage regulator and 2N3055 pass transistor are mounted to the rear apron of the Drake R-4C on a small homebrew 2-1/2 × 3-3/4 × 1/2-inch (63.5 × 95 × 12.5-mm) open-bottom box.* This shallow box is fastened to the rear of the Drake R-4C with a pair of 1/2-inch (12.5-mm) threaded standoffs (photo). In this way, only two small, inconspicuous holes need to be drilled in the Drake R-4C. Wires are cabled and routed through a grommet inserted into one of the slots in the back apron and through the power transformer grommet, to the underside of the chassis. Small, finned heatsinks of the Walefield 680 type cool both voltage regulator and pass transistor.

references

1. J.R. Sherwood and G.B. Heidelman, "Present-Day Receivers — Some Problems and Cures," *ham radio*, December, 1977, pages 10-18.
2. H.J. Sartori, "Solid-Tubes — A new Life for Old Designs," *QST*, April, 1977, pages 45-50.
3. H.J. Sartori, "New Circuits and ICs Improve Receiver Performance," *73*, June, 1979, pages 32-36.
4. H.J. Sartori, "Technical Notes — R4 Receiver," Sartori Associates, P.O. Box 2085, Richardson, Texas 75080.
5. R. Klinman, "Improved AGC for the Drake R-4C," *CQ*, March, 1980, pages 44-46.
6. J.R. Sherwood, "New R-4C Audio Amplifier," *Application Note*, Sherwood Engineering, Incorporated, 1268 South Ogden Street, Denver, Colorado 80210.

*This miniature open-bottom chassis can be easily fabricated from 1/16-inch (1.5-mm) aluminum sheet. Alternatively, the regulator and transistor may be mounted on a flat rectangular 2-1/2 × 3-3/4-inch (63.5 × 95-mm) plate. The 1/2-inch (12.5-mm) lip covers the electrical connections to the regulator circuit.

ham radio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RF OUT A
RF OUT B
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TMPSNS A
GROUND
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BIAS B
HD201

In about an hours time you can improve not only your receiver but your chances of working that rare one or perhaps hooking that extra multiplier in a contest.

How to Improve The Automatic Gain Control (AGC) In The Drake R4C Receiver

BY RICHARD KLINMAN*, W3RJ

The first thing I noticed when listening with my R4C receiver was the extremely flat behavior, or wide range, of the Drake AGC circuit. Operation in this respect was similar to my solid state Heath SB303. Experience with the Heath receiver led me to believe that it would be difficult to pick out calls in pile-ups with the R4C, and this fear was supported by initial on-the-air tests. The characteristic of the R4C that makes its use in s.s.b. contests and DX situations difficult for me are 1) the extreme pumping in the fast, "F", AGC position, and 2) the extreme flatness of the overall AGC characteristic. Once a received signal exceeds S3 on my receiver absolutely no noticeable increase in audio output occurs with further increase in the strength of the received signal. As with the Heath receiver, the Drake engineers did a great job in producing such a flat AGC response. For casual QSO's or broadcast listening this response is ideal. However, it is my opinion that this characteristic response is undesirable for DX and contest work. What happens in a pile-up is that each time a signal stronger than the one you are concentrating on pops up, the stronger signal becomes exactly as loud as the one you were trying to copy while the desired signal is "buried" by the decrease in receiver gain. A related effect is the observation that adjacent channel QRM in the receiver passband has a tendency to modulate the gain, or pump the AGC, with the Drake AGC characteristic. Operation with the AGC off is much better in difficult situations, but loud signals in that mode hurt your ears and distort severely. This problem is described in detail by Rusgrove[1], who sought an elegant but complex general solution.

The typical AGC characteristic of the Drake R4C is shown in fig. 1. Notice that, as observed during general listening, once the AGC threshold is reached there is practically no increase in audio output with further increases in r.f. signal at the antenna. Also, the threshold is set for a very low level signal. This curve is consistent with the specifications of the receiver which claim a threshold of about 1 microvolt, or S3, and a 3db maximum audio increase with 100 db of increase in antenna signal level. Measurement of this characteristic response is not unique since it depends upon the sensitivity of the receiver, setting of the r.f. gain and bias controls, and range of signals used at the antenna. Fig. 1 also indicates the typical response of the R4C with the AGC off. Somewhere in between these two curves is what I consider the optimum AGC response. Indicated on the graph is the AGC response of the Collins 75S3B receiver. While not necessarily optimum, the receiver has so far proven itself as an unequaled performer. The 75S3B AGC characteristic response should provide a guide as to what should be the goal of any change in

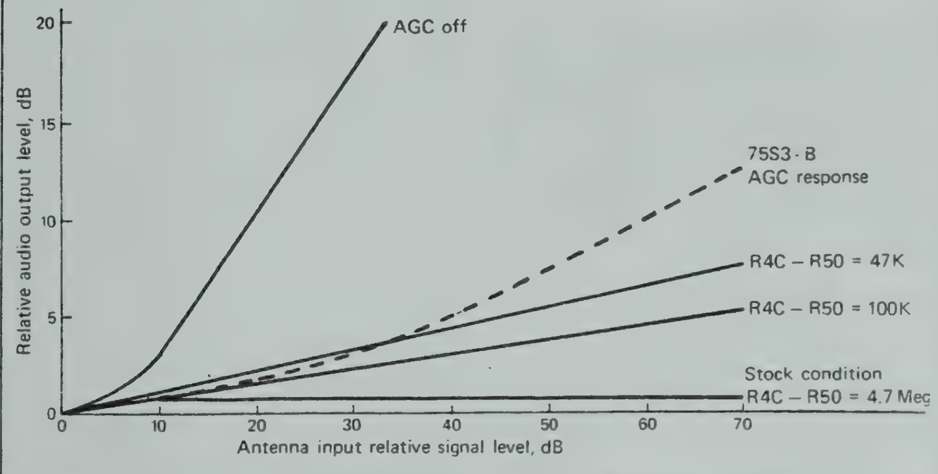

Fig. 1 - AGC characteristics of the Drake R4C receiver.

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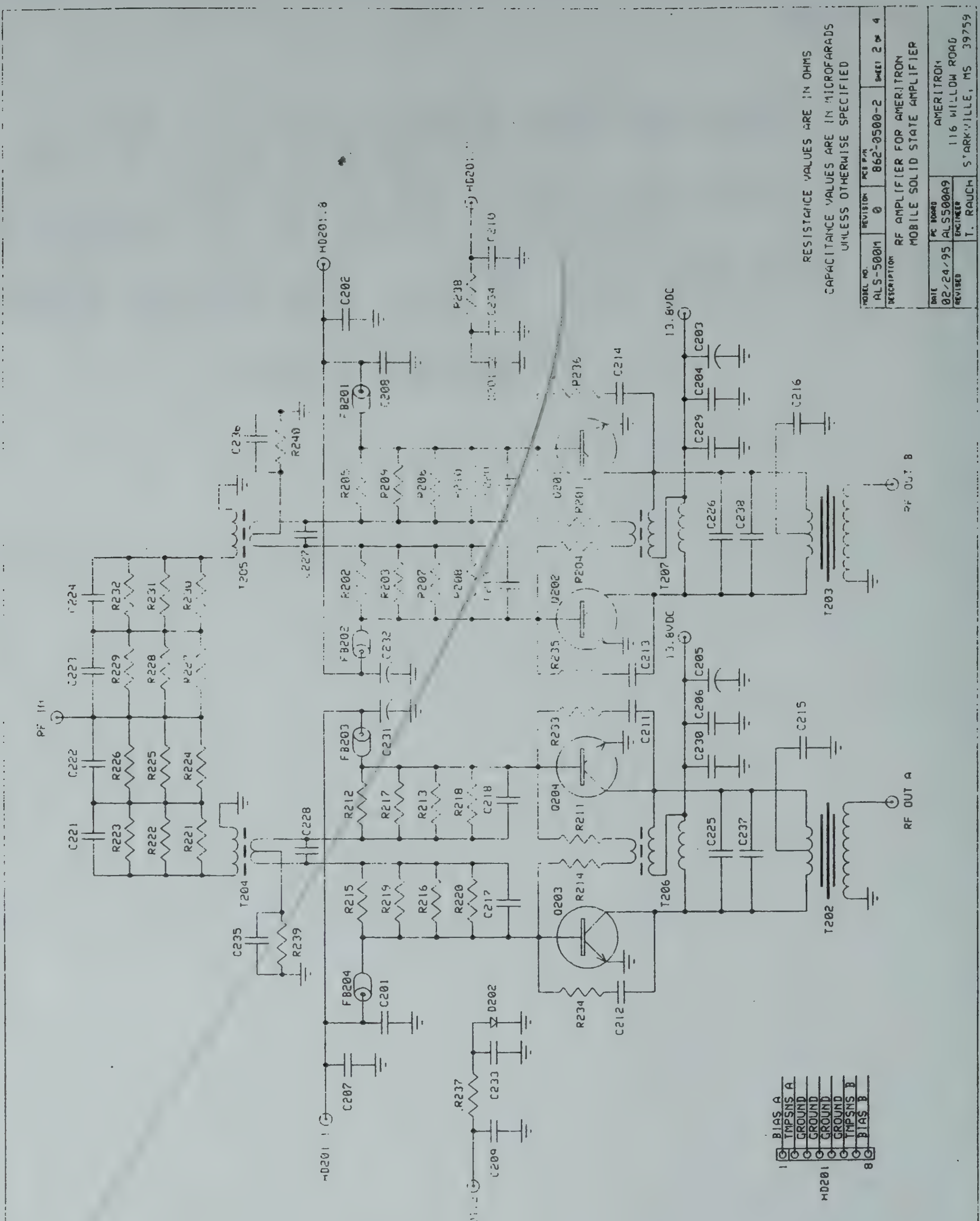
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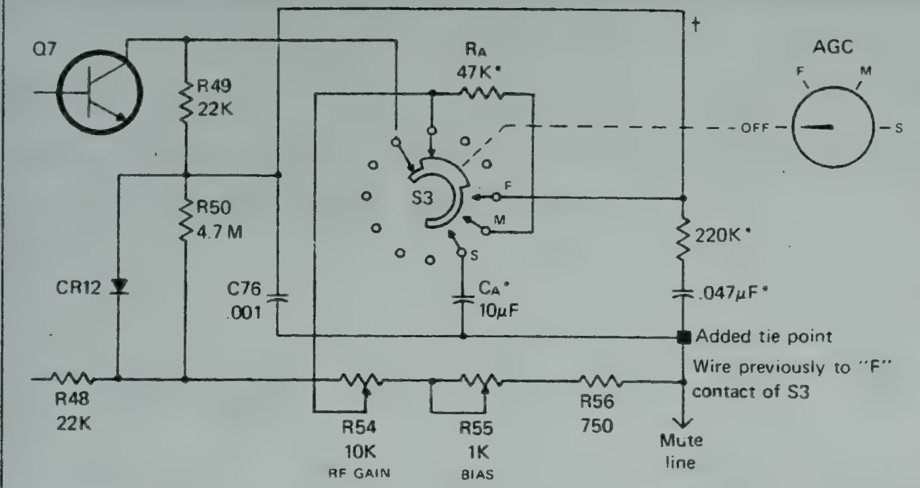


*Fig. 2-The modified R4C receiver AGC circuit. * indicates an added component. † indicates a wire previously from the "S" contact of S3 to R51. All resistors are 1/4 watt and all capacitors are 50 volts minimum.*

the R4C response.

The extreme AGC response of the R4C arises from the extremely large value of load resistor R50 (4.7 Meg) in the AGC amplifier Q7. Because of the large resistor value the gain of the AGC loop is very high resulting in the capacity of the R4C to correct for large swings in the receiver input signal. Simple reduction of the value of R50 is an easy way to reduce the AGC loop gain. The exact value selected for R50 is a matter of personal choice. A reasonable compromise is 47K. Larger resistance values will result in more AGC action, and less resistance will result in reduced AGC action. The AGC time constant can be adjusted by adding capacity across the new value resistor used in place of R50. Increasing capacity results in slower AGC decay time constant. The AGC characteristic response obtained with a 47K resistor shunting the 4.7 Meg R50 is shown in fig. 1. (The response can be further tailored by altering the value of R49, which effects the distribution of AGC voltage between the AGC1 and AGC2 control lines, and altering the threshold of the AGC action by altering either R21, R41, or R46. A great deal of empirical work is necessary to achieve a desired response.)

Operational Notes

Implementation of the revamped AGC circuit is very easy, taking less than an hour to complete. The circuit of the revision I used is shown in fig. 2. Operation of this circuit is such that in the

1. "OFF" position of S3 operation is with no AGC,
2. "F" position of S3 operation is identical to stock factory operation in the medium AGC mode,
3. "M" position of S3 operation is with the new AGC characteristic with a fast decay time constant,
4. "S" position of S3 operation is with the new AGC characteristic with a slow decay time constant.

Operation of the S-meter is altered only slightly. It will move quite rapidly in the "M" position of S3 and not be able to respond to signal peaks. This is of no operational consequence.

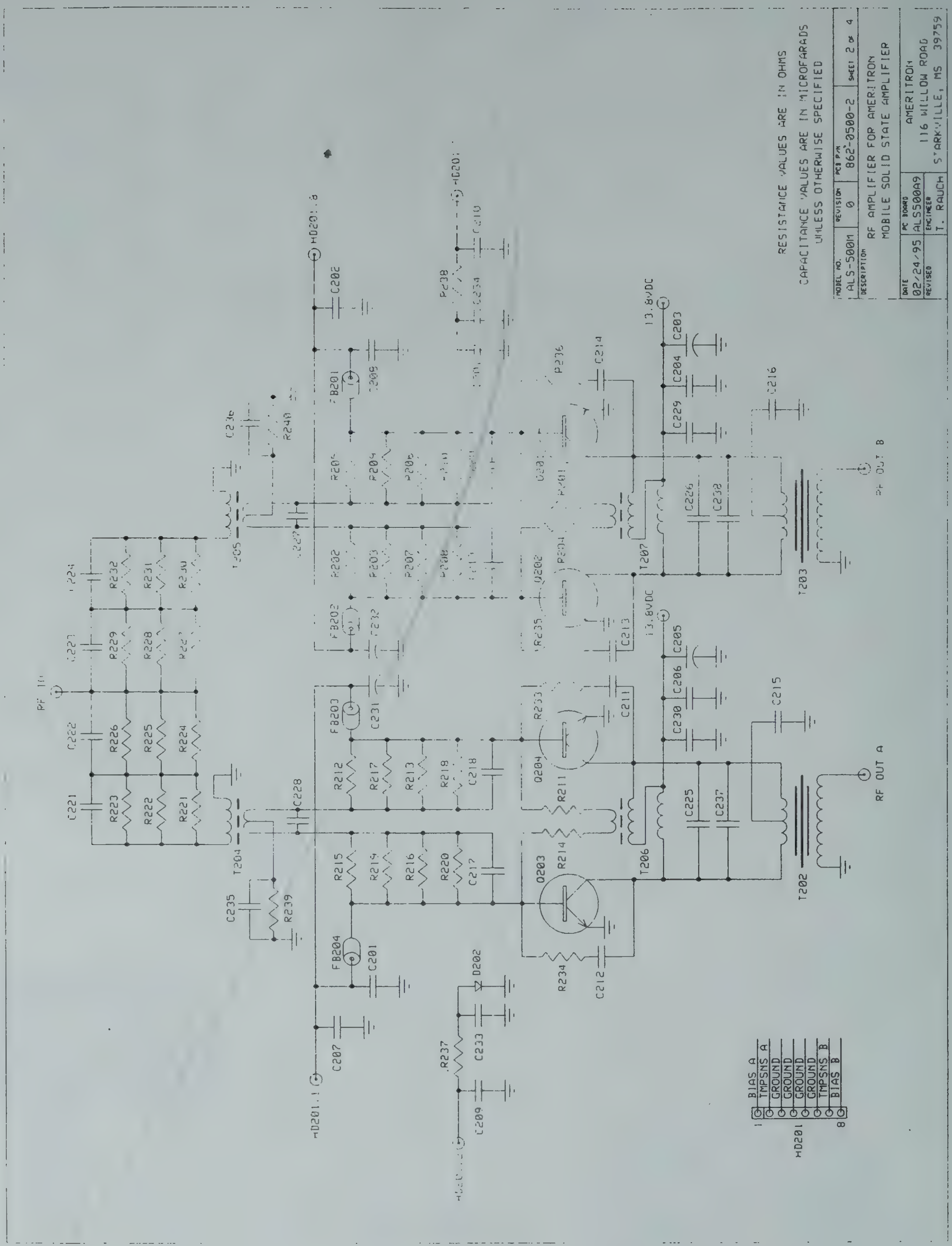
Modification Sequence

Physical modification to the R4C is minimal. All extra parts are mounted directly on the AGC switch, S3. No additional wires need to be added to the receiver. A simple step-by-step procedure for the modification is given below.

1. Remove one wire each from the three right hand contacts of the AGC switch S3. These are the F, M, and S contacts. The F contact can be identified because it is the only contact touching the center ring in the F position, and it is the top-most contact to your right as you face the radio with the front panel toward you. Note the color coding of these wires as the wires to the F (black, white, brown) and S (brown, red, white) contacts will be re-used. Cover the end of the wire from the M contact with insulation spaghetti and push it out of the way.
2. Use a piece of heavy solid wire to make a solder tie point in the unused contact hole adjacent to the F contact. This can be done by looping a short piece of wire through the hole and around the outside edge of the wafer. Leave a 1/8" stub to solder to.
3. Connect the wire that was previously on the F contact (black, white, brown) to the new tie point.
4. Connect the wire that was previously on the S contact (brown, red, white) to the F contact.
5. Connect a 10uF capacitor from the S contact to the new tie point. If a polarized capacitor is used, connect the + side to the tie point.
6. Connect a 220K resistor in series with a .047uF capacitor with short leads between these two parts. Connect this series R-C network from the F contact to the new tie point.
7. Connect a 47K resistor from the M contact to the contact immediately to the left of the top of the switch. This contact should have two wires (purple-white) connected to it. These wires connect to the front panel RF gain control, R54. In either the R4C schematic or fig. 2 this wire connects to the junction of R54, R50, R48, and CR12.
8. On the AGC printed circuit board, located between the audio output transformer and the s.s.b. crystal filter, disconnect the wire (brown, red, white) on the tie pin that connects to R51 (33K). Check to see that the other end of this wire has been connected to the F contact of S3. Connect this wire to the end of C73 (.22uF) closest to the chassis. This point should be the junction of C73, R50, R49, and R70. The wire just moved is the lead marked "†" in fig. 2.

Modification of the AGC circuit is now complete. Values of R_A and C_A may be altered as personal preference dictates. Restoration to the "stock" condition is accomplished by reversing the preceding eight steps.

[1]J.B. Rusgrove, "Human Engineering the Station Receiver", QST Vol. 63, No. 1 (Jan 1979)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BIAS B
HD201

W3RJ shows us how to provide full break-in and improve the keying to tur. these two Drake units into a super contest machine.

Full Break-In With The Drake T4XC-R4 Using The Vacuum Relay QSK

BY RICHARD KLINMAN*, W3RJ

In a series of previous articles I described a vacuum relay break-in, or QSK, system, its station interconnection, and the modifications to several transmitters necessary to achieve QSK.[1,2,3] Although the concepts are spelled out in these articles, many local Drake enthusiasts encouraged me to work out the details for the Drake T4XC-R4C combination. This note is a summary of the procedure I used to incorporate QSK with this radio. Anyone considering running break-in with the Drake should carefully review the previous articles which lay the groundwork for these simple modifications.

If you are reading this note for general information and own a T4X, please take note. In this article I describe how to modify the c.w. keying wave shape of the T4X to eliminate the stock overly hard keying characteristics. The two additional capacitors needed to correct the "thumpy" keying are very simple to install, so please try them. Your neighboring amateur friends will appreciate the five minutes work involved.

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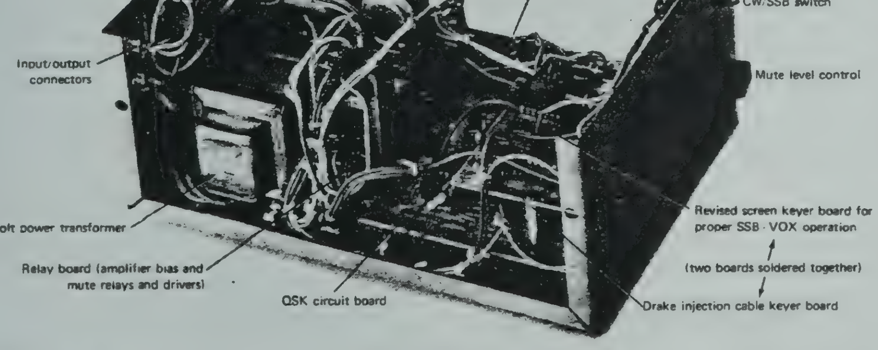
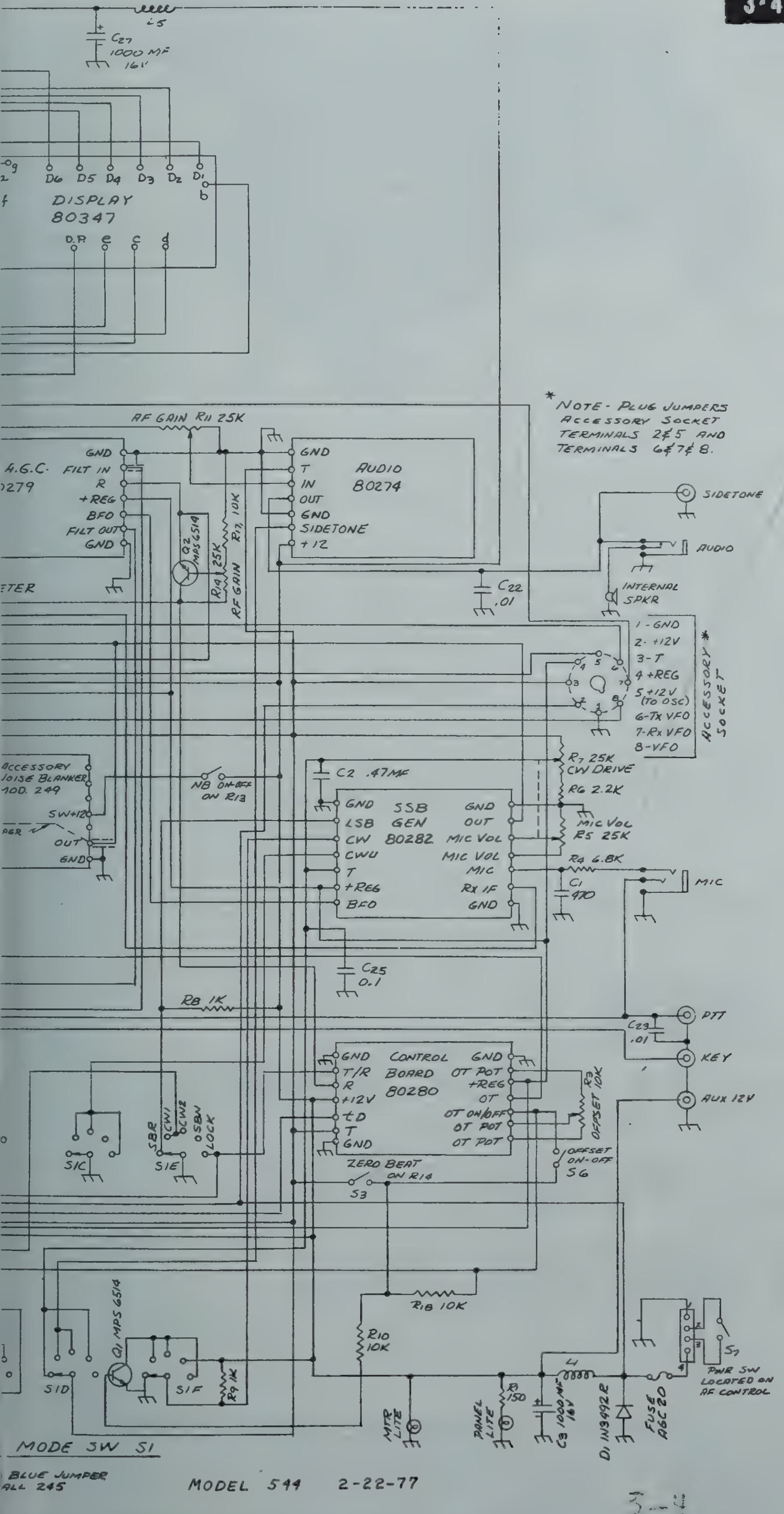


The QSK box of W3RJ. This unit has been described in previous issues of CQ. Check the references at the conclusion of the article for specific issues and dates. The box itself is 8" × 6" × 3½" and is a Bud CU-2109A Minibox.

Break-in with the T4XC-R4C

The constraints on modification of the transmitter are unchanged from my previous efforts, namely (1) the ability to return to "factory" operation without having to re-modify the equipment when the QSK is not being used, (2) minimum modification to the transmitter, and (3) absolutely no mechanical modification to reduce resale value. Modification of the Drake was simpler than either the Collins or Heath, but there was one complication which was, nevertheless, easily overcome. As delivered from Drake, all necessary low level stages in the transmitter are keyed thereby eliminating the main "backwave". The final amplifier screen supply line is broken for keying of these tubes to eliminate idling current during key-up. Mechanical modification of the transmitter consists of adding four phono jacks in existing spare ¼" holes provided on the rear panel. These jacks are connected to (a) the screen supply voltage, (b) the final amplifier screen grid connection, (c) the push-to-talk, PTT, line, and (d) the transmitter PTO lamp grounding switch connection.

As with the Collins and Heath, the carrier oscillator produces a low level "backwave" signal when the transceive cables are connected in c.w. The "injection" cable provides the spurious path for this unwanted sig-



*NOTE - PLUG JUMPERS ACCESSORY SOCKET TERMINALS 2 & 5 AND TERMINALS 6 & 7 & 8.

MODEL 544 2-22-77

3-4

Use the largest value capacitor that does not result in an overly soft, or mushy, sound when keying at full exciter output power. In my case a .02uF 1kv disc was added across C32. Fig. 4 shows these two necessary modifications.

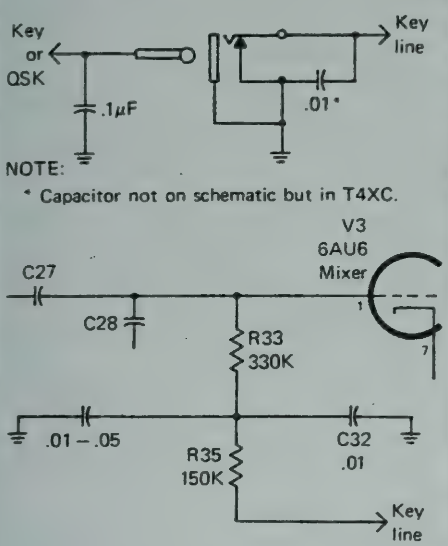
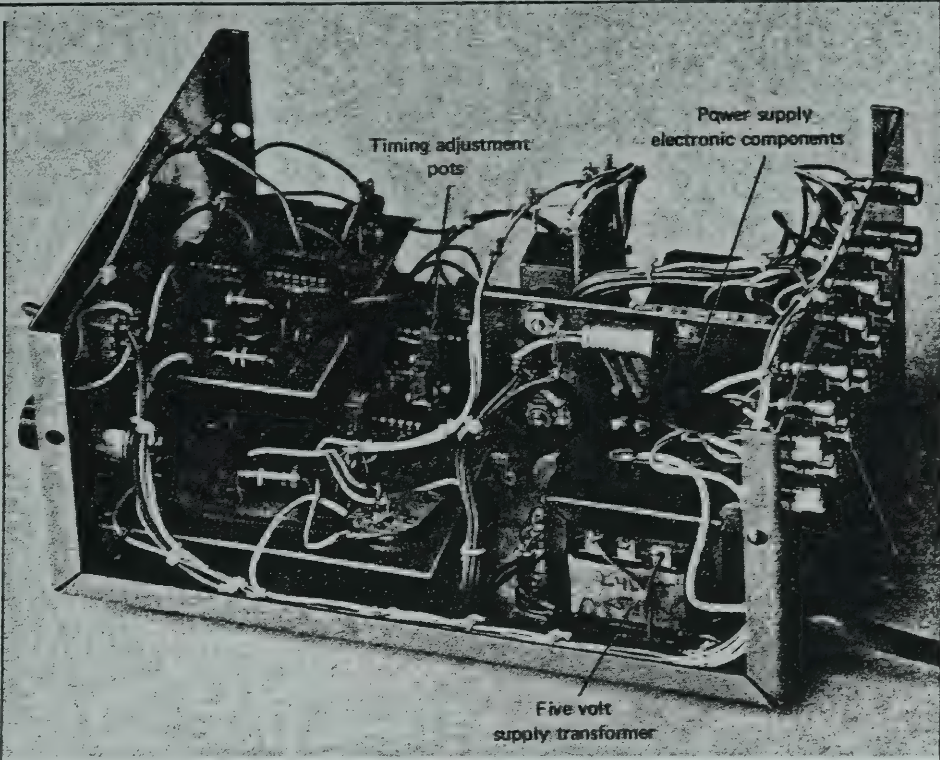


Fig. 4- Modifications to improve the keying wave shape.



The QSK box as seen from the other side. This unit has the new screen keying and Drake injection boards.

The last modification concerns the operation of the VOX circuit in the PTT mode. Since the VOX controls are inaccessible from the front panel, the fellows at Drake had a good idea in putting a VOX/PTT switch on the front panel. However, they did not quite finish the job. While the PTT switch does inhibit the microphone signal from triggering the transmitter during PTT, once the PTT is actuated the VOX hold time delay must still pass until the transmitter is returned to standby. This wait is undersirable during rapid contest style PTT operation. Drake was nice enough to provide an unused set of contacts on the PTT switch S7. I have used those extra contacts to control a miniature reed relay to reduce the VOX delay to zero when in the PTT mode. The circuit of this modification is shown in fig. 5 and the layout for a corresponding printed circuit board is shown in fig. 6. The board is mounted in the relatively empty center of the transmitter by soldering a ground lug to the final amplifier shield running parallel to the front panel and adjacent to the right angle take-off from the band switch. The filament voltage is taken from the fused side of fuse F1. Ground one unused lug of S7B by connecting a jumper between it and the grounded terminal of S7A. Run a wire from the remaining switch terminal of S7B to the circuit board as indicated in fig. 5. Run the wire with the cable harness passing through the chassis. The contacts of the relay, K2, on the circuit board are brought to the VOX circuit board where they are connected to the two wires going to R72, the s.s.b./a.m. delay control. These are on a connector pin with the green-white wire and a connector pin with the black-white wire on the VOX board. Since the minimum delay time was too long for my taste, I also shorted R67, 220k, on the VOX board with a jumper. Instantaneous PTT operation is possible with S7 in the PTT mode, and normal VOX operation occurs in the VOX mode.

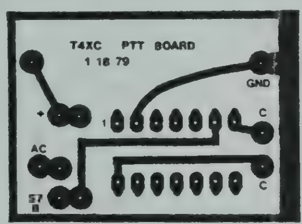


Fig. 6- The circuit board for the T4XC PTT modification as seen from the foil side. Shown actual size.

Modification of the QSK

Additional logic circuitry is needed in the QSK to drive the injection cable keying relay. This logic circuit is shown in fig. 7 and is built on the circuit board of fig. 8. The relay is mounted in a small mini-box with three

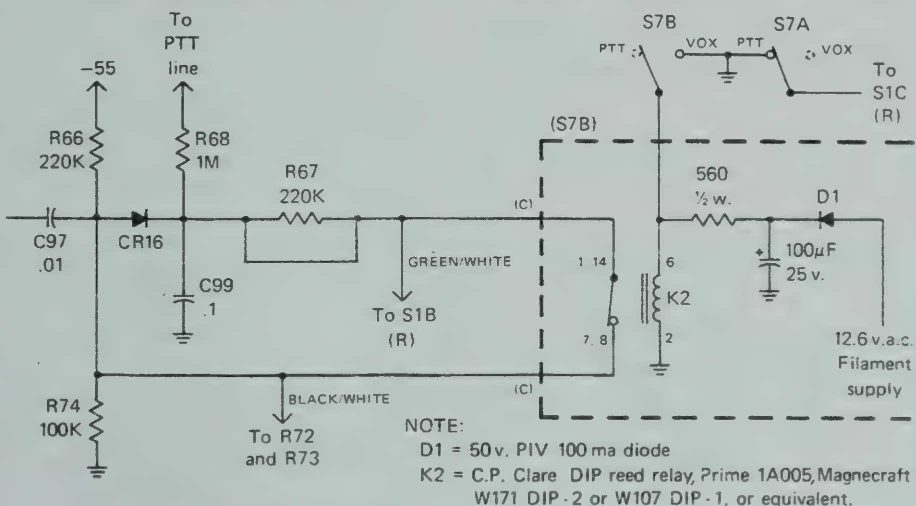
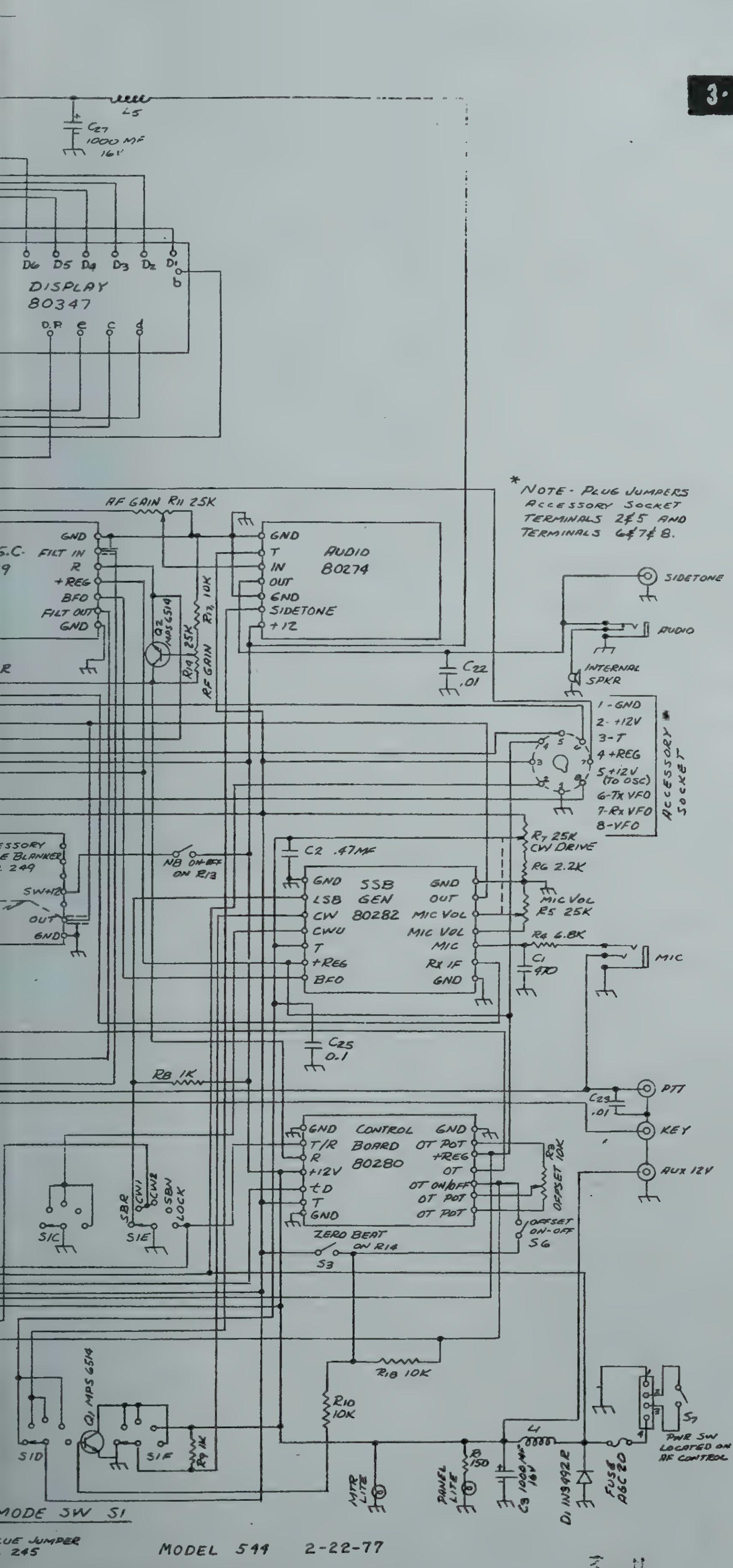


Fig. 5- Modification to the T4XC VOX to eliminate VOX delay during PTT and reduce the minimum VOX delay time. Printed circuit board connections are labeled ( ).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Q2 MPS 6514
R19 25K
R13 10K
RF GAIN
AUDIO 80274
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*NOTE - PLUG JUMPERS ACCESSORY SOCKET TERMINALS 2&5 AND TERMINALS 6&7&8.
SIDETONE
AUDIO
INTERNAL SPKR
1 - GND
2 - +12V
3 - T
4 +REG
5 +12V (TO OSC)
6 - TX VFO
7 - RX VFO
8 - VFO
ACCESSORY SOCKET
R7 25K CW DRIVE
R6 2.2K
MIC VOL R5 25K
R4 6.8K
C1 470
MIC
C2 .47MF
NB ON-OFF ON R13
SW+12
OUT
GND
SSB GEN 80282
GND LSB CW CWU T +REG BFO
GND OUT MIC VOL MIC VOL MIC RX IF GND
C25 0.1
R8 1K
PTT
C23 .01
KEY
AUX 12V
CONTROL BOARD 80280
GND T/R R +12V ±D T GND
GND OT POT +REG OT OT ON/OFF OT POT OT POT
R3 OFFSET 10K
OFFSET ON-OFF S6
ZERO BEAT ON R14
S3
SBR CW1 CW2 SBN LOCK
S1C S1E
R18 10K
R10 10K
Q1 MPS 6514
S1D S1F R9 1K
MTR LITE
PANEL LITE
R 150
L1
C3 1000 MF 16V
D1 1N3492R
FUSE AGC 20
S7
PWR SW LOCATED ON RF CONTROL
MODE SW S1
MODEL 544 2-22-77

3-4

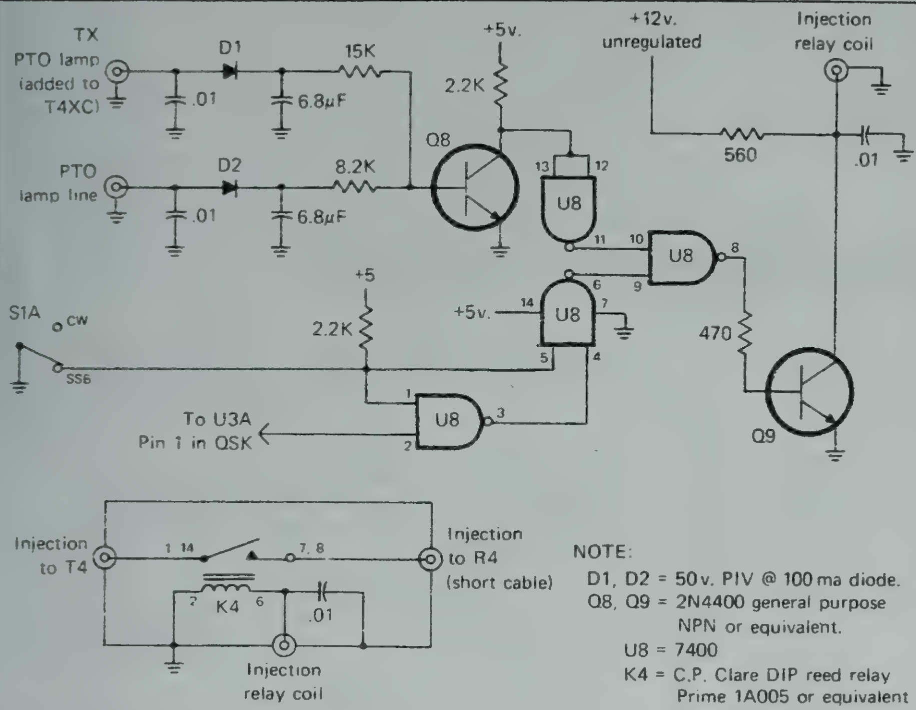


Fig. 7- The injection cable keying circuit. This circuit is located inside the QSK. Printed circuit board connection points are labeled with ( ).

phono-jacks on it. Keep leads in this box as short as possible as the injection cable does not like additional loading. I cut the existing injection cable into a long and short piece and placed shielded phono jacks on the cut ends. The shortest piece is used between the relay and the receiver. The circuit functions so that in the separate mode the relay contacts are always open. Intransceive the relay is keyed along with the antenna relay in c.w. and always energized in s.s.b. Three additional phono-jacks must be added to the QSK back panel for the receiver PTO lamp line, the transmitter PTO lamp line, and the injection cable relay coil drive.

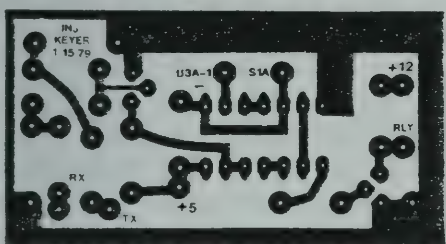


Fig. 8- The circuit board layout for the injection cable keyer as seen from the foil side. Shown actual size.

Interconnection and Operation

Interconnection of the QSK is described in the previous QSK articles.[1,2,3] In addition, connect cables to the QSK from the existing PTO lamp jack by using a phono-jack "Y" patch cord, from the added transmitter PTO lamp jack, and from the injection cable relay coil. Initial testing should be done in stages by (a) making sure the transmitter operates without the QSK by jumpering the "screen" and "+250" jacks and attempting normal separate operation, (b) connecting the QSK and vacuum antenna relay and obtaining satisfactory operation in the separate mode, and (c) connecting the transceive cables and injection keying relay. No backwave should be heard on c.w. during transceive. In c.w. the VOX relay will be continuously closed. S.s.b. operation is as described in the T4XC manual.

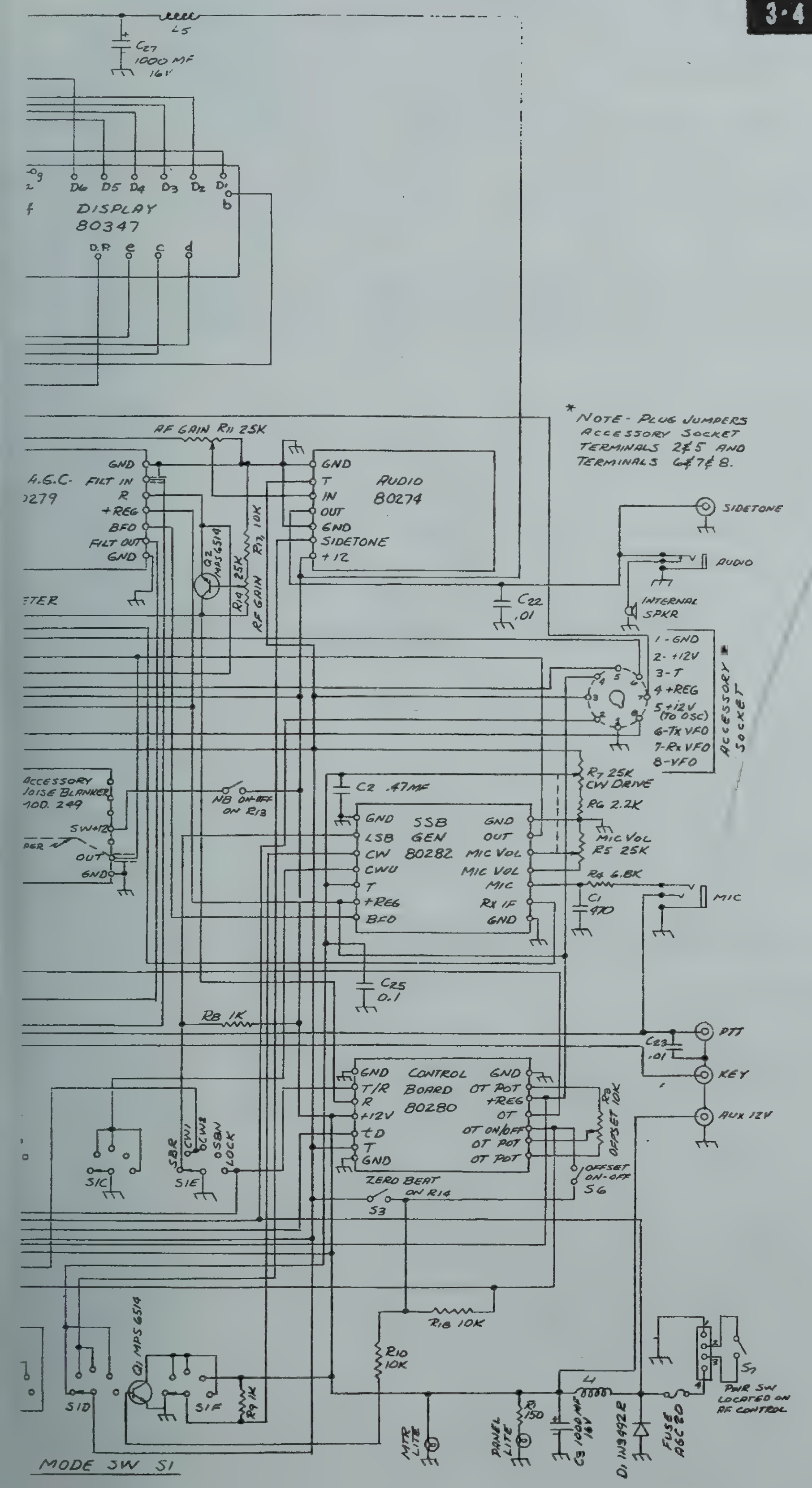
Remember that transceive in c.w. with the transmitter PTO is not possible. Restoration to "factory" condition is possible by simply removing all cables to the QSK, patching the injection cable directly from receiver to transmitter, and jumpering the "screen" and "+250v" jacks with a phono cable. In this configuration conventional antenna change over relays must be used.

References

[1]Klinman, R., "A Vacuum Relay TTL QSK Antenna Switch", *CQ*, July 1976.
[2]Klinman, R., "Vacuum Relay QSK In A Commercially Equipped Station, Part I: The Collins S-Line", *CQ* December 1977.
[3]Klinman, R., "Vacuum Relay QSK In A Commercially Equipped Station, Part II: The Heath SB400/401", *CQ*, July 1978.
[4]Klinman, R., "Drive Equalization And Isolation Amplifier - Collins S-Line V.F.O. Injection", *CQ*, April 1979.

CQ DX Tip

—Pay attention to fan and room noise, and breathing noise. If these produce detectable output signal deflection on the reflectometer, you have built in QRM! Some stations run a one-man pile-up. Even good stations may only give 20 dB Signal/Noise due to this local noise pickup. —*W4MB*



*NOTE - PLUG JUMPERS ACCESSORY SOCKET TERMINALS 2 & 5 AND TERMINALS 6 & 7 & 8.

MODEL 544 2-22-77

new audio amplifier

for the Drake R-4C

A new audio amplifier for the Drake R-4C, suitable for direct substitution in all R-4C versions

Improvements in the Drake R-4C receiver, up to now, have been confined mainly to the i-f and detector systems.[1,2,3] One remaining area which needs improvement is the audio strip, which suffers from buzz and higher-than-desirable distortion; it also dissipates 7 to 10 watts of heat near the PTO. The audio amplifier, diagramed in **fig. 1**, eliminates these problems. While intended as an R-4C retrofit, this circuit performs so well that we also recommend it for other communications uses.

Our circuit is designed around National Semiconductor's LM383T, which, with the R-4C low-voltage supply, can deliver in excess of 2 watts into a 4-ohm load. The LM383 and associated components* can be mounted on a copper-clad board 3.8 cm (1½ inches) square, or another appropriate small heatsink (for a V_{cc} of 16 volts or less). It should be installed just behind the front-panel phone jack, between the passband-tuning capacitor and long i-f shield on which the Sherwood CF-600/6 may be mounted. This location provides access to the speaker lead and detected signal at the audio gain pot. It also keeps the circuit away from power transformer hum fields in the chassis.

circuit precautions

The secret of making the LM383 an unconditionally stable audio amplifier (suitable for field installation in various layout configurations) is our output stabilization network. Proper stabilization is accomplished by connecting a 1.0-μF monolithic ceramic capacitor (such as Sprague 5CZ5U105X0050C5) with 19-mm (3/4-inch) leads directly between pins three and four of the LM383. Use of a lower-value capacitor with significantly longer *or* shorter leads will virtually guarantee oscillation problems. Tantalum or aluminum electrolytics *cannot* be substituted for the monolithic capacitor.

Other circuit values have been chosen to tailor the audio response for greatest communications intelligibility. As in the original R-4C circuit, low frequencies are rolled off at one end of the needed spectrum; high-frequency shaping is similar to that of our suggested modification.[1] The feedback network has been chosen to provide nearly 40 dB of power-supply ripple rejection, minimizing the need for abnormal amounts of filtering. Gain at 1 kHz is 40 dB.

component selection

As with any high-gain amplifier, feedback and hum loops between the input and output should be avoided. Return all signal and power leads to pin 3, except for V_{cc} bypass, which should be returned to the IC tab with a solder lug.

To reduce component size, the 0.22-μF and 10-μF capacitors can be 16-volt (or greater) tantalums. The 200-μF electrolytic at pin 2 can have a 3-volt rating. The 300-μF output capacitor should have a minimum rating equal to V_{cc} (20 volts maximum). Sixteen volts is adequate for the R-4C. As mentioned above, a small heatsink is used for a V_{cc} less than 16 volts; above 16 volts a large heatsink. Never exceed a V_{cc} of 20 volts.

installation

To disable the existing amplifier, lift the output

By **J. Robert Sherwood, WBØJGP,** and **George B. Heidelman, K8RRH,** Sherwood Engineering, Incorporated, 1268 South Ogden Street, Denver, Colorado 80210

*A parts kit will be available from G. R. Whitehouse, Newbury Drive, Amherst, New Hampshire 03031.

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Overview

The permanent resident (PR) card is a wallet-sized, plastic status card that replaces the paper IMM 1000 Record of Landing document for travel purposes. On December 31, 2003, the permanent resident card became the proof of status document required by permanent residents seeking to re-enter Canada on a commercial carrier (airplane, boat, train or bus).

Permanent residents seeking to return to Canada who are without a permanent resident card may contact the nearest Canadian visa office to obtain a limited use travel document to re-enter Canada at a cost of $50 for each one.

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Safe, secure and confidential

The PR card protects the privacy of the cardholder:

- Only non-secure information is printed on the card
- Personal information from the IMM 1000 Record of Landing or the Confirmation of Permanent Residence document is encoded and accessible only to authorized officials

The PR card includes state-of-the-art security features:

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- Micro-text printing
- Tactile lettering
- Ultra-violet images

transistor's collector lead at its solder lug. Also, remove its base or emitter wire, and/or disconnect one end of the driver's 100-ohm collector resistor. Connect the new amplifier's output to the phone jack terminal *with* the sleeved wire from the audio output transformer, and bypass with a 0.01-μF capacitor. This secondary is still used to provide the needed step-up for anti-vox system.

The only ground return should be a short, thick, insulated wire, run from pin 3 directly to the cable-braid terminal of the audio gain pot (rear section of

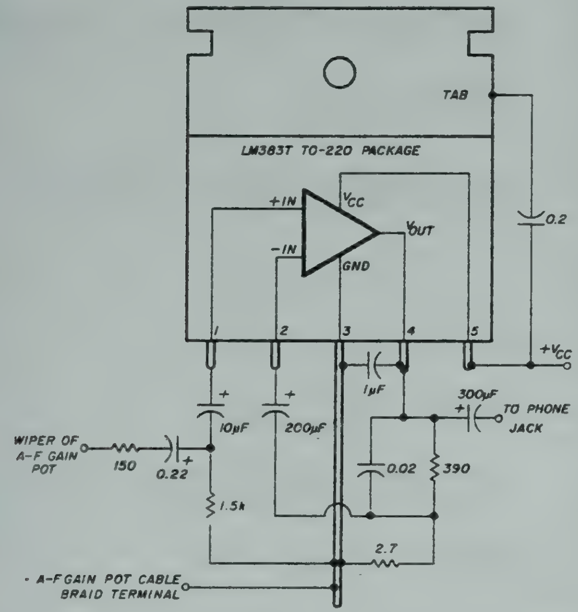

fig. 1. Schematic diagram of the new audio amplifier for the R-4C, based upon the LM383T audio amplifier IC. Resistors are ¼ watt. As pointed out in the text, all ground returns must be made through the connection to pin three to eliminate hum and feedback problems. The 1-μF monolithic ceramic capacitor *must* have 19-mm (¾-inch) leads (see text).

the dual control.) Do not allow the board or heatsink to touch any other part of the receiver ground. Next, add a small wire between the audio gain-control braid terminal and a close chassis ground. Disconnect the existing wire from the gain pot center wiper terminal, and connect the new amplifier input to this lug. Connect V_{CC} to the original audio-strip printed circuit board terminal with the blue wire from the audio-output transformer primary.

references

1. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "Present-Day Receivers — Some Problems and Cures," *ham radio*, December, 1977, page 10.
2. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "New Product Detector for the R-4C," *ham radio*, (ham notebook), October, 1978, page 94.
3. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "New Product Detector for the R-4C," *ham radio*, (short circuits), February, 1979, page 94.

ham radio

The PR card helps to combat illegal entry into Canada:

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Learn more about the PR card in this section. If you do not find the information you are looking for and you are calling from Canada, feel free to contact the **PR Card Call Centre**.

- About the Process
- About the Permanent Resident Card
- Frequently Asked Questions
- Application for a Permanent Resident Card (PR Card)
- Application for a Travel Document (Permanent Resident Abroad)
- Important Information for Urgent Cases

Overview | About the Process |
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Last Updated: 2004-03-01 Important Notices

split-frequency operation with the Drake R-4B receiver and the TR-4 transceiver

Modifications you can make to your Drake receiver and transceiver to enhance operating convenience and versatility

This article describes how I increased the versatility of my Drake TR-4 transceiver for split-frequency operation using a Drake R-4B receiver as an external VFO.

I purchased a used R-4B receiver, and the thought kept passing through my mind that it would sure help if I could use it to control the TR-4 transmit frequency (as in the R-4 TX-4 combination).

analysis

The Drake R-4 receiver and the TR-4 use different i-fs; therefore there's no direct interface as with the TX-4. After studying the circuit diagrams, it occurred to me that it should be very easy to duplicate the control circuit of the Drake RV-4 remote VFO and make use of only the VFO portion of the R-4B to control the TR-4.

The control circuit described was built and minor modifications were made to the R-4B to interface with the TR-4. The R-4B can be used as a separate receiver, then switched to remote VFO operation.

Circuit modifications don't interfere with R-4B normal operation. The added components can be removed in a few minutes at resale time to restore the receiver to its original condition.

The main problem in the project is the fact that there's a 45-kHz difference in VFO operating frequency between the TR-4 and R-4B. This is apparently because of the 50-kHz second i-f of the R-4B. There's no reason why the VFO frequency can't be decreased 45 kHz to match the TR-4 VFO output; then the crystals in the premixer oscillator can be changed to oscillate 45 kHz higher to compensate for the VFO downward shift. I breadboarded the circuits to test the idea and everything worked as planned.

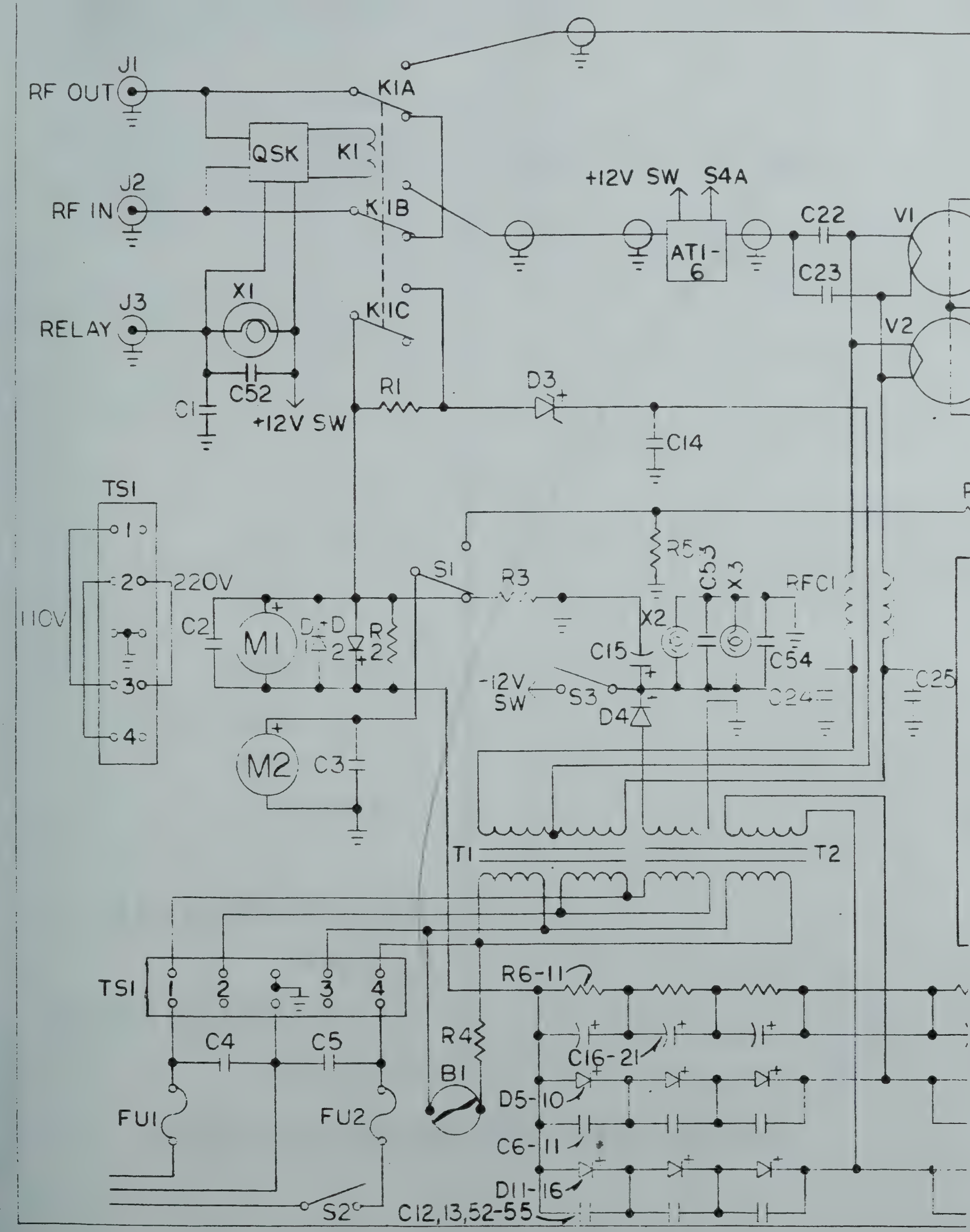
control circuit

I duplicated the control circuit of the RV-4 (**fig. 1**) and mounted it in a small minibox. This minibox sits on top or alongside the TR-4 to interface the R-4B. Only two critical items are in the control circuit. One is peaking coil L1 at the grid of V1 (12AU7); it must match the coax cable from the VFO to the 12AU7 grids.

The diagram in my manual didn't give a value for L1 so I experimented a bit. I reclaimed a vhf coil form from some surplus gear and wound 70 turns of no. 30 (0.25 mm) enamel wire on the 6.5-mm (¼-inch) slug-tuned form. Too few or too many turns would not peak the 5-MHz signal, so the number of turns must be adjusted. A scope is a great aid in tuning L2.

The other critical item is the four-position special switch, A1. After tracing the functions of the Drake switch, I discovered that a standard four-position, five-pole switch would do the job. These parts could be ordered from Drake, but I used all junkbox parts.

By William P. Winter, Jr., WB8JCQ, O'Higgins 3168 Buenos Aires, Argentina



J1
RF OUT
K1A
QSK
K1
J2
RF IN
K1B
+12V SW
S4A
C22
V1
ATI-6
C23
J3
RELAY
X1
K1C
V2
C52
R1
D3
C1
+12V SW
C14
TS1
R5
C53
X3
RFC1
S1
R3
220V
110V
C2
M1
D1
D2
R2
X2
C15
C54
-12V SW
S3
C24
C25
D4
M2
C3
T1
T2
R6-11
R4
C4
C5
C16-21
B1
D5-10
FU1
FU2
C6-11
D11-16
S2
C12,13,52-55

The 1-mH rf choke from TR1 collector is from an old TV set. Any coil will work as long as it has a good number of turns. Transistor TR1 turns the VFO B+ on and off through the rf choke and the coax line going to the R-4B receiver.

control switching

Position 1, separate receive. The 330-kilohm resistor in **fig. 1** is connected through S1D to B+, turning TR1 on, causing its collector to saturate. Thus TR1 collector goes low, pulling the 10-Vdc B+ line to the R-4B VFO toward zero, which turns the VFO off. The slide switch on the side of the R-4B must be forward to disconnect the control unit, thus defeating the above action. The VFO output is now sent to V8 (premixer) cathode. The R-4B operates normally.

Position 2, receive. The 330-kilohm resistor is connected through S1D and S1E to pin 5 of the Jones plug. This is receive cathode ground. During receive TR1 base goes low, cutting it off, and the B+ to the VFO goes high, which allows the VFO in the R-4B to operate during receive only. During transmit the receive cathode goes high, turning the R-4B VFO off. Note that the slide switch on the side of the R-4B must be toward the rear to switch the VFO output from V8 mixer to the control unit.

Position 3, transceive. The 330-kilohm resistor is connected through S1D and S1E to ground, turning TR-1 off, thus allowing the VFO B+ to rise to normal. This allows the VFO in the R-4B to operate on transceive.

Position 4, transmit. During transmit only, the 330-kilohm resistor is connected to ground through S1C and pin 3 of the Jones plug to the transmit cathode. TR1 is cut off allowing the VFO B+ to rise, enabling the R-4B VFO. During receive, the transmit cathode goes high, turning on TR1, which pulls the VFO B+ down so that the R-4B VFO can't operate.

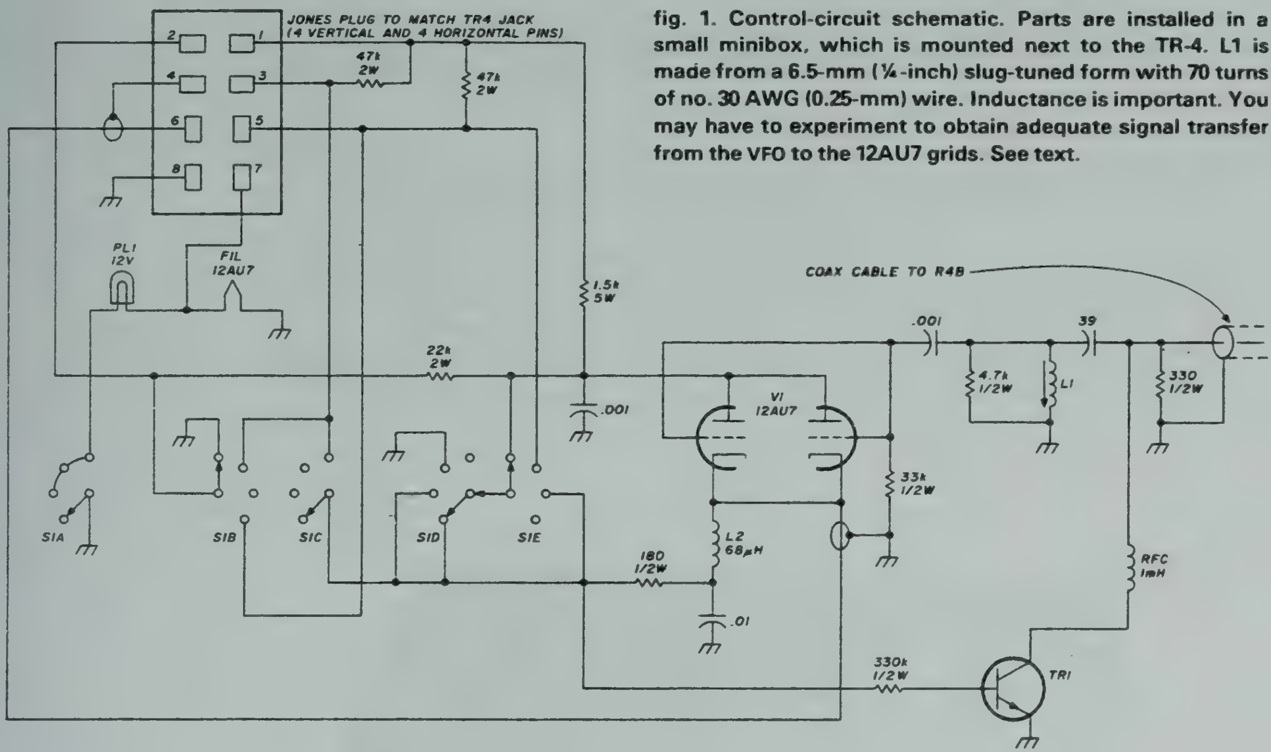


fig. 1. Control-circuit schematic. Parts are installed in a small minibox, which is mounted next to the TR-4. L1 is made from a 6.5-mm (¼-inch) slug-tuned form with 70 turns of no. 30 AWG (0.25-mm) wire. Inductance is important. You may have to experiment to obtain adequate signal transfer from the VFO to the 12AU7 grids. See text.

The 12AU7 is a cathode follower with both sections in parallel. It functions as an impedance transformer giving a low impedance output to feed the TR-4. At the same time, the 12AU7 acts as a switch to disconnect the signal from the remote VFO. The cathode is switched high or low at the appropriate time according to the switch position and the TR-4 transmit-receive relay.

control-circuit layout

Nothing is critical about the control-circuit layout, since it is primarily composed of dc switching lines. However, some attention should be paid to the rf components related to the 12AU7 grid. Leads should be short, and accepted rf-wiring practice should be used.

Transistor TR1 can be any silicon npn device with a voltage rating of about 40 volts. The coax cable from the R-4B to the control unit, and the cables

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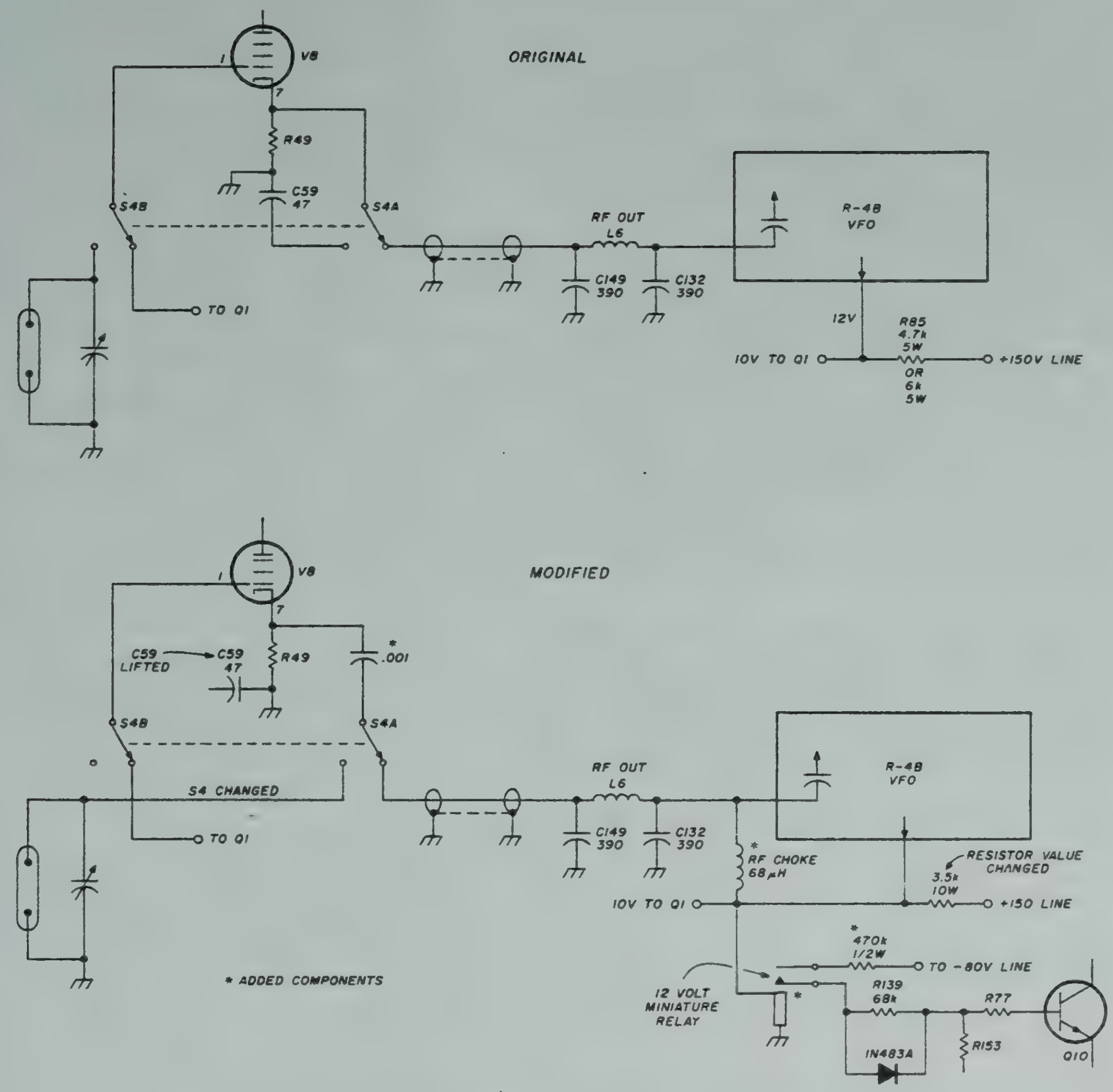


fig. 2. Before and after mods to the Drake R-4B receiver.

from the control unit to the Jones plug, should be as short as possible. *Caution*: Do not insert or remove the Jones plug in the TR-4 while the rig is on; otherwise the TR-4 transistors may be damaged.

R-4B modifications

Of the five modifications described, only the first two are needed to make the R-4B receiver function as a remote VFO. Modifications 3 through 5 are optional. The modifications to be described involve:

1. Changing the value of power resistor R85

2. Changing the position of three wires on S4

3. Adding four components to switch the neon VFO indicator lamp

4. Changing the VFO dial

5. Changing the crystals and adding padding capacitors if desired

Fig. 2 shows the R-4B circuit before and after modification.

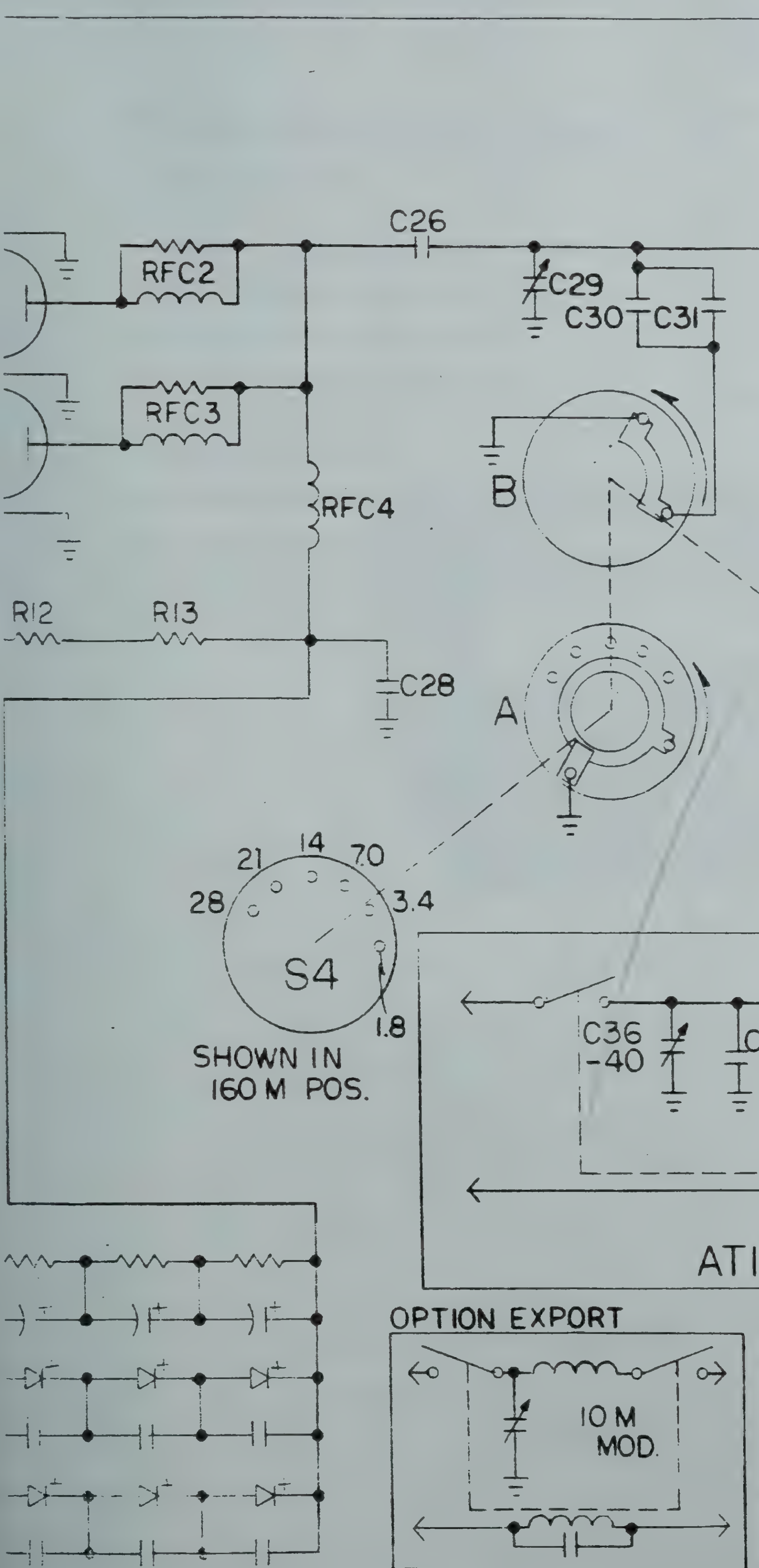
Modification 1. Provide VFO output from the fixed-channel crystal jack on the side of the R-4B by following these steps:

1. Lift C59 from S4A. Bend C59 so that it doesn't touch anything. Leave it there for restoration at resale time.

2. Locate the jumper that comes from the fixed-channel crystal jack to S4B. Lift the connection from S4B and solder it to the lug on S4A where C59 was removed.

3. Locate the wire that comes from V8 pin 7. Lift if from S4A middle lug.

4. Lift VFO output coax center conductor from S4A and move it to S4A middle lug (vacated in **step 3** above).



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10, FEB. '84'

LK-5013

ZB

5. Place a small 0.001-μF ceramic capacitor in series with the wire removed in 3 above. Solder the other lead of the capacitor to S4A where the coax formerly was connected. This blocks the 10-Vdc control voltage, which we will place on the VFO output line, from reaching V8.

We have now modified S4 to provide the following switchings: Forward: regular R-4B receive mode. Back: VFO output to crystal jack, receiver disabled. The fixed-frequency crystal socket is now the VFO output jack. A length of RG-59 carries the R-4B VFO signal from this jack to the control box. I soldered the pins of a defunct crystal to the ends of the coax so I could plug the coax into the crystal socket.

Modification 2. Dc switching of the R-4B VFO is accomplished from the control unit by placing an rf choke from the 10-volt VFO B+ line to the rf output line from the VFO. A convenient spot is between the two solder tabs on the circuit board just behind the audio gain control. I used a 68-μH choke from my junk box. The value isn't critical as long as it presents a high reactance at 5 MHz. Check that resistor R85 can handle the additional dissipation when the 10-volt line is shorted to ground by the control box. R85 must drop the entire 150 volts from the +150-volt line. The control unit now enables the TR-4 to turn the R-4B VFO on and off in the same manner as in the remote RV-4 VFO.

Modification 3. Switching the neon VFO indicator lamp is optional but enhances operating convenience. I purchased a surplus 12-Vdc, 10-mA miniature relay and mounted it on a long bolt, which I installed where the audio output transformer is mounted. Your mounting will depend on what relay you have available. (See the comments on relay selection.) The following steps are necessary for this modification:

1. Connect the relay coil from the +10 volt line to ground.

2. Place a 470-kilohm resistor from the normally open contact (normally open with coil energized) to the −80 volt line. A convenient spot is the solder tab that has a white wire with a green stripe (on my R-4B). This is the negative lead of C91, which is the 8-μF, 150-volt filter of the −80 volt line. It's located on a small vertical board behind the notch-depth control, which is mounted on the right-side panel.

3. Locate the board containing Q10. It's mounted below the VFO and just behind the front panel. Connect the other relay contact to the junction of R139 (68k) and D15 anode.

The relay functions as follows. When the TR-4 control box is set to inhibit a signal from R-4B VFO, the +10 Vdc line goes low (3 volts or lower). This action de-energizes the relay just installed, connecting negative cutoff bias to transistor Q10, which causes NE2 to be extinguished.

4. R85, 4.7-kilohm, 5 watts, should be changed to a 3.5-kilohm, 10-watt resistor if you use a 10-mA relay as I did. Extreme care should be used here. With the original 4.7-kilohm resistor, the additional current drain caused the normal 10-Vdc regulated voltage to drop below the zener regulation point. Reducing the value of R85 allows an additional 10 mA of current to be drawn, and the zener will still regulate at 10 Vdc. Do not operate the VFO with the lower resistance value without the relay coil connected, as the additional current will probably blow the 250-mW, 10-volt zener mounted inside the VFO enclosure. Easy does it!

If you use a relay with a coil other than 10 mA, 12 Vdc, adjust the value of R85 accordingly or perhaps provide a separate supply to drive the relay by a transistor. An alternative method would be to put a pre-regulator on the line (12 to 15 volts) with a zener of enough power-handling capability to do the job.

Modification 4. If you wish dial calibration on the R-4B identical to that on the TR-4, it will be necessary to order a TR-4 dial from Drake. (The price in June of 1978 was \$2.00, plus \$1.00 handling, plus postage.) It's installed in the following manner:

1. Remove all front-panel knobs (some slip on; others have a set screw).

2. Remove nut on the function selector switch.

3. Remove four screws at corners of the front panel. Be careful to catch the fiber spacers behind the panel (they're hard to find when they fall and roll across the floor).

4. Remove the two screws holding the metal shield over the neon bulb. Be extremely careful *not* to bend the neon-bulb leads, because then break very easily; many standard replacement neon bulbs will not fit. I had to cut a hole in the shield to allow the end of the bulb to stick out.

5. Very carefully remove the front panel without unduly bending the neon-bulb leads. Lay aside the clear Plexiglas sheet with the red line. Do not lose the pressure washer. Note how it came off so it can be replaced in the same way.

6. Remove two screws holding the pilot light shield mounted behind the panel.

7. Remove the two C-rings from the VFO shaft. You'll need a C-ring tool; it can be purchased in auto parts shops. Be careful! The C-rings are tight and are hard to remove. (I broke my tool and had to use a wheel puller to remove the first C-ring). The second C-ring wasn't so tight. *Important*: Note the position of these C-rings so they can be replaced in the exact spot.

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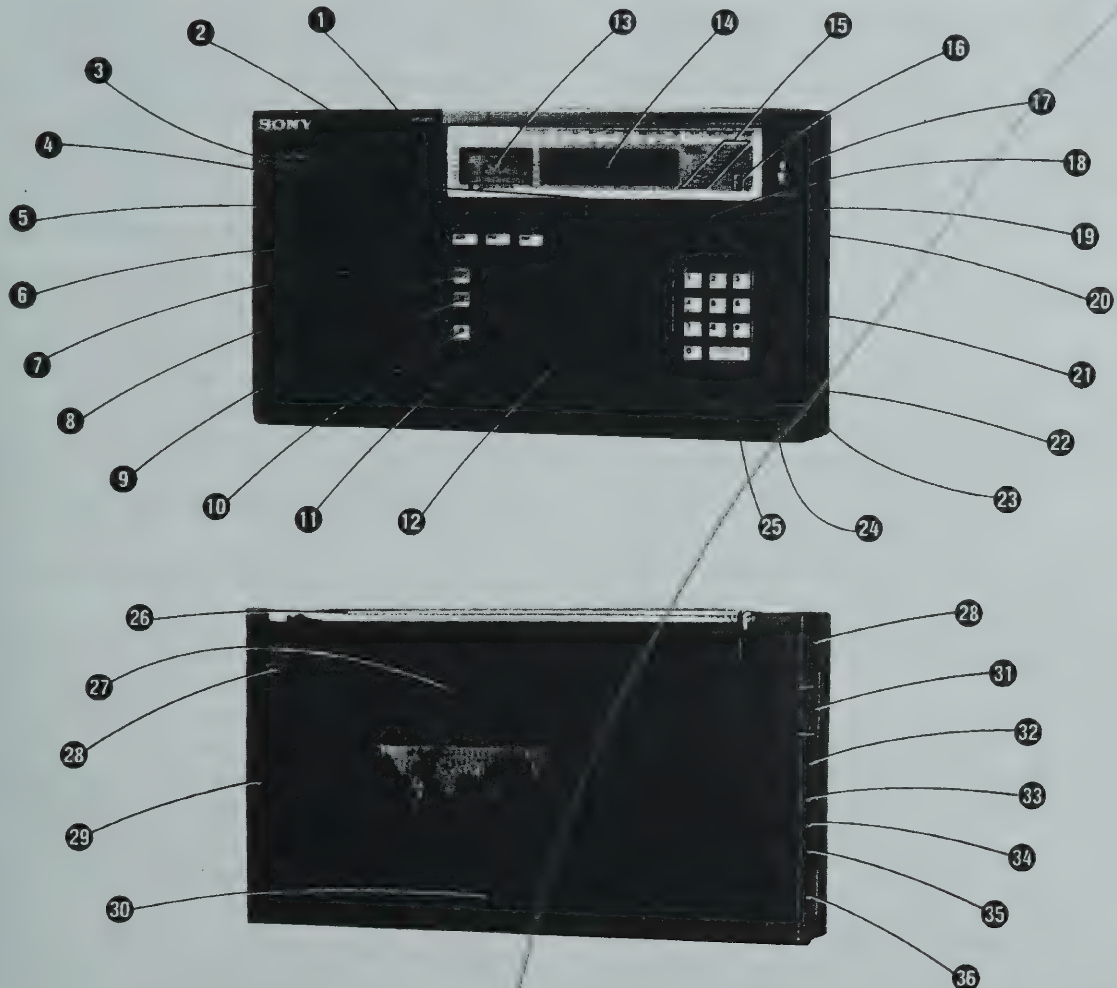
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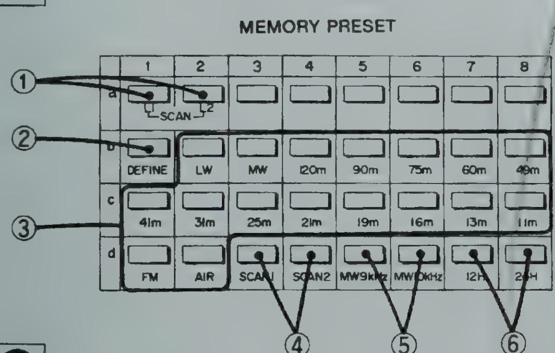
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c
41m 31m 25m 21m 19m 16m 13m 11m
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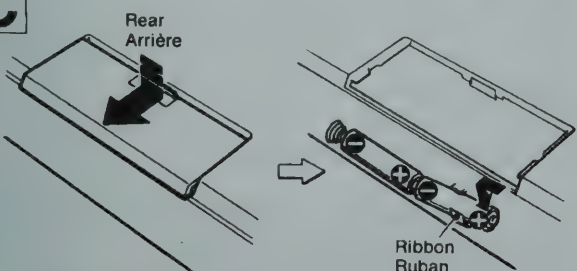
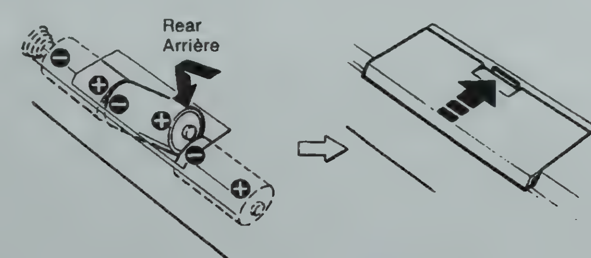
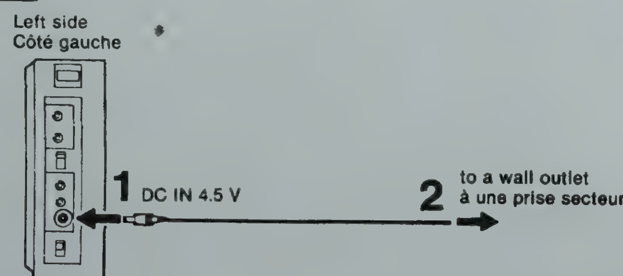

Rear
Arrière
Ribbon
Ruban

D


Rear
Arrière

E


Left side
Côté gauche
1 DC IN 4.5 V
2 to a wall outlet
à une prise secteur

8. Locate, identify, (make a drawing), and remove the three leads coming out of the VFO.

9. Remove the three nuts holding the VFO in place. Lift and remove the VFO assembly from the R-4B.

10. Turn the VFO shaft to find the final stop. Noting *exactly* where it was positioned (pencil mark), remove the dial by removing the large C-ring. Place the TR-4 dial in the same position.

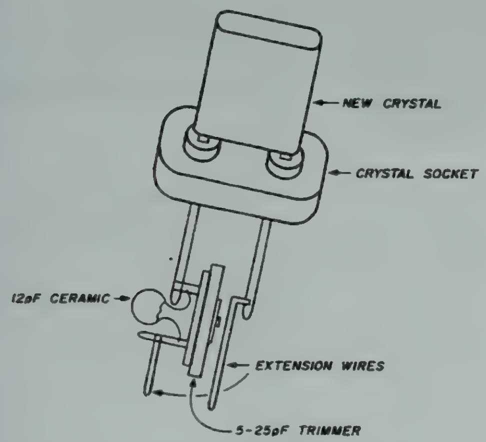


fig. 3. Construction of the crystal paddler, which plugs into the R-4B receiver crystal socket.

11. Reassemble, following the steps above in reverse order.

Modification 5. To track the VFO for TR-4 use and separate receiver use, I ordered new crystals that are 45 kHz higher in frequency than the originals. For the 20-meter band to tune backward, as in the TR-4, I substituted a crystal frequency (14.645 MHz), which is added, rather than subtracted, to the VFO output to obtain the proper injection frequency.

This, by the way, is the same crystal needed for 80 meters. Therefore, by installing an appropriate jumper and one other change, the same crystal can be used for both 20- and 80-meter operation.

To keep expenses down I ordered only three crystals (my cost locally was $20.00 for the three crystals): one for 80 meters, which doubles for 20 meters; one for 15 meters, and one to receive WWV on 15 MHz. Thus I've covered my needs at the present. For the same crystal to be used for both 80 and 20 meters, the following steps are required:

1. Find C53 (68 pF) in parallel with R47 (1.5 kilohms). This network is the collector load for Q1 at 25.1 MHz. Lift these two components from S5F and dress them out of the way so they don't touch anything but are handy for replacement at resale time.

2. Place a jumper from C55 (68 pF) to the switch tab vacated above. Solder the connections.

3. Place an insulated jumper wire from the 14.6-MHz crystal jack to the 25.1-MHz jack. (The 25.1-MHz crystal will no longer be used.) Put it away so it will be handy at restoration time.* The jumper should be placed in the holes toward the front panel. The new crystal, 16.645 MHz, can now be plugged into the 14.1-MHz jack. Eighty-meter operation is as normal; 20-meter operation now tunes backward, as in the TR-4.

crystal padding

I found it necessary to put a trimmer in series with the new crystals to trim the R-4B receive frequency to exactly the same dial calibration as when using the R-4B as a remote VFO. I used a 12-pF ceramic cap in parallel with a small 5-25 pF variable, which I removed from some surplus equipment (see **fig. 3**). The cap is smaller than the standard-size trimmer and will fit between the solder tabs of a standard-size crystal socket. The capacitors are in series with one lead of a crystal socket adapter, which is plugged into the main crystal socket.

dial calibration

Dial calibration is as follows:

1. Calibrate the TR-4 dial as usual, using the TR-4 internal crystal calibrator.

2. Switch the control unit to receive from external VFO. Calibrate the external VFO dial (R-4B dial) in the same manner as the TR-4.

3. Switch the control unit to separate receive (don't forget to throw the slide switch for separate receive). The R-4B should now operate normally. Adjust the trimmer mounted below the new crystal to zero beat.

summing up

Now you can receive a station on the R-4B and then switch immediately to transceive on the same frequency by simply selecting transceive on the control box and moving the slide switch on the side of the R-4B. You're now transmitting with R-4B VFO control. It's a good idea to check the dial calibration from time to time to make sure that everything is still calibrated, otherwise you'll have a small frequency offset when switching to transmit from the R-4B.

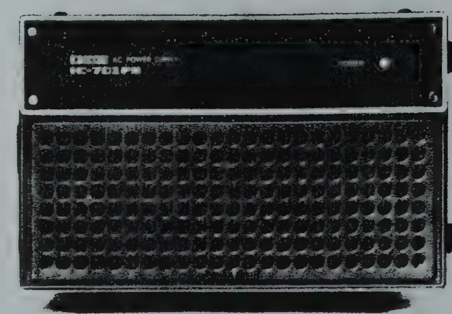
You have greatly increased the versatility of the TR-4/R-4B combination, and, if your experience is like mine, you'll also have greatly increased your operating pleasure.

ham radio

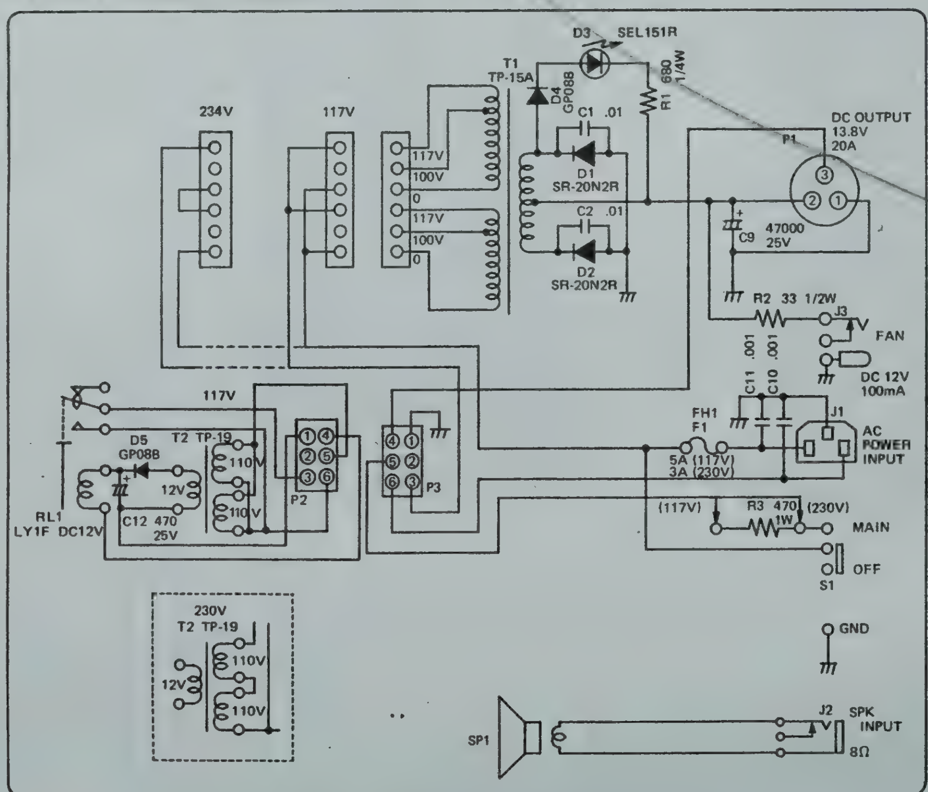
*The steps in these modifications should be kept in a file with your equipment literature. Appropriate annotations to the steps will come in handy when you decide to restore your radio for resale. Editor.

IC-701PS
AC POWER SUPPLY

INSTRUCTION MANUAL

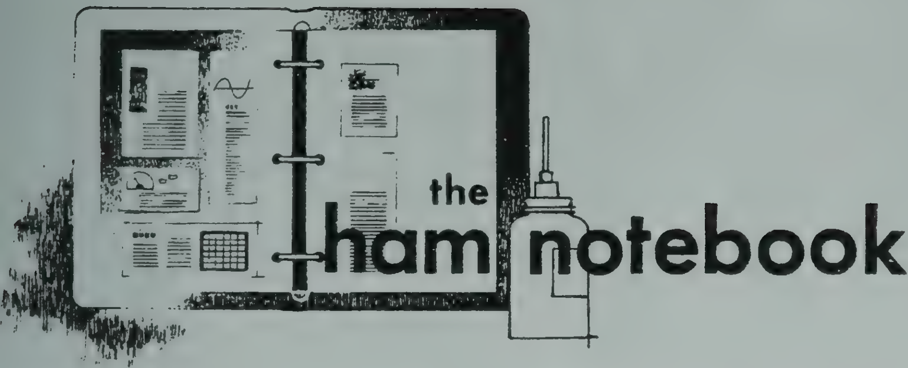


■ IC-701PS SCHEMATIC DIAGRAM



ICOM INCORPORATED
1-6-19, KAMI KURATSUKURI HIRANO-KU,
OSAKA JAPAN

ICOM



the ham notebook

general coverage using the Collins 75S receiver

A recent article in *QST*[1] detailed a relatively simple and inexpensive method for extending the frequency coverage of the 75S-1. However, this particular method did not allow for proper operation of the receiver, especially with regard to transceive operation, since the correct tuned circuits for the preselector, rf, amplifier, and crystal oscillator circuitry are not necessarily selected. The method I've employed for some months does allow for split or transceive operation, is somewhat more flexible, and requires only a slight modification to the receiver.

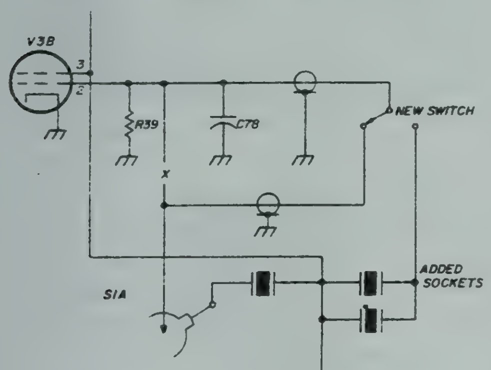


fig. 1. Schematic diagram of the change to the 75S-series receivers to permit general coverage while still maintaining transceiver capabilities. The two additional sockets are mounted on a small metal bracket above the present crystal bank.

An aluminum bracket is drilled to accept two crystal sockets and a miniature spdt switch. One socket accepts HC-17/U, and the other, HC-6/U crystals. The bracket is secured to the left side rail over the existing crystal sockets. The dimensions of the bracket allow its right side to rest on the tops of the crystals in sockets 1, 2, and 3E, providing more rigidity.

The switch is mounted with the handle pointing left/right for instant recognition of NORMAL or GENERAL COVERAGE. Two solder lugs are attached under the socket nearest the switch for coax braid connections. The coax lead that normally goes from V3B, pin 2, to the arm of S1A, was broken at the V3 side and passed through the hole near the front panel to the new switch. A new piece of coax is run from the switch to V3B. The rest of the wiring is done with hookup wire. Attachment to the common point of the sockets may be made at crystal socket 3E.

With the switch in the NORMAL position, the 75S-1 operates with the standard compliment of crystals. In the GENERAL COVERAGE position, a properly chosen crystal may be inserted and *with the band switch selecting the proper frequency range*, operation outside the amateur bands (or extended 10-meter coverage, for instance) is accomplished. The bandswitch position is especially important when operating the receiver in transceive with the 32S series transmitters. A similar modification could be made to the transmitter, although this has not as yet been attempted.

Paul Pagel, N1FB

reference

1. Vernon L. Gibbs, W4JTL, "An extended Frequency Range for the Collins 75S-1," *QST*, October, 1977.

new product detector for the R-4C

As mentioned in a previous article,[1] the product detector in the Drake R-4B and R-4C leaves room for improvement. The present design allows the audio to leak back into the last i-f stage, from where it is detected, causing the AGC to vary at an audio rate. To correct this error we developed a reasonably simple product detector which eliminated the problems. Unfortunately, as stated in the article, the main disadvantage of the MC1496 was the high number of external components.

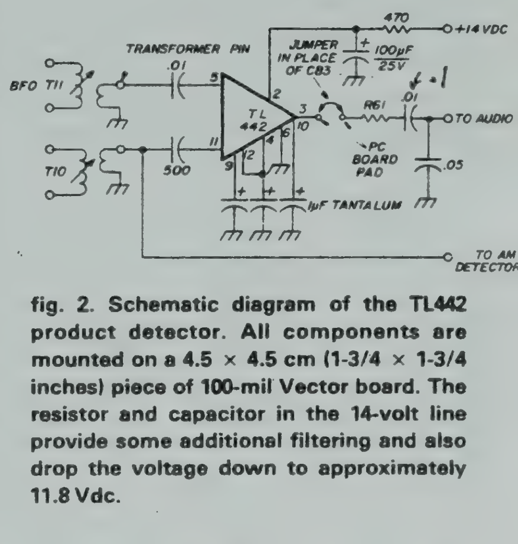


fig. 2. Schematic diagram of the TL442 product detector. All components are mounted on a 4.5 × 4.5 cm (1-3/4 × 1-3/4 inches) piece of 100-mil Vector board. The resistor and capacitor in the 14-volt line provide some additional filtering and also drop the voltage down to approximately 11.8 Vdc.

In recent correspondence with Howard Sartori, W5DA, he suggested another device which has also proved suitable as a product detector, the TL442 from Texas Instruments. As seen in **fig. 1**, the

*A parts package for this product detector is available from G. R. Whitehouse, Newbury Drive, Amherst, New Hampshire 03031.

See correction Feb 79

Thank you for choosing the IC-701PS. This unit is an AC Power Supply for the IC-701, ICOM's Digital All Solid State HF Transceiver.

SPECIFICATIONS

• Number of Semi-conductors:	Silicon diode	4
	LED	1
• Input Voltage (suitable voltage):	117/230V AC (50/60 Hz)	
• Allowable voltage fluctuation:	±10% of input voltage (suitable line voltage)	
• Input Capacity:	360VA (at 20A load)	
• Output Voltage:	DC13.8V (at 20A load)	
• Max. Load Current:	20A (10 minutes ON/10 minutes OFF 50% duty cycle)	
• Polarization:	Negative ground	
• Internal Speaker:	125 x 77 mm 2 watt nominal input 4 watt maximum	
• Dimensions:	110 (H) x 180 (W) x 260 (D) mm	
• Weight:	Approximately 8 kg	
• Accessories included:	AC power cord	1
	Spare fuse	2
	Speaker cord	1

BEFORE USE

This is an AC power supply for the IC-701 and is designed to be turned ON and OFF with the power switch on your IC-701; this unit does not have a separate power switch.

As this unit has 20A maximum capacity at 13.8V DC, it is recommended that you do not use this unit with other than the IC-701, even for experimental purposes.

HOW TO USE

Connect the DC output plug of this unit to the IC-701 power connector securely, as shown in the figure at right. At this time, make sure that

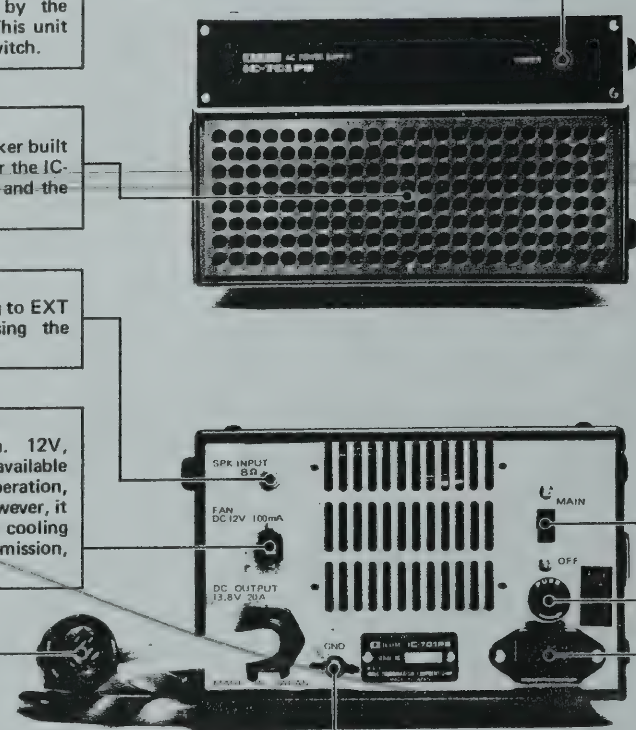
(1) the power switch on the IC-701 is OFF,

(2) the T/R switch is at the RECEIVE position, and

(3) no microphone is connected.

Connect the AC power cord to the AC power connector on the rear panel of the IC-701PS. Connect the AC power cord plug in the power outlet. At this time, the remote control relay in this unit will be at the stand-by position. By turning the IC-701 power switch ON, this unit will be turned ON and the power display LED illuminated. For further operating information, see the instruction manual for the IC-701.

FUNCTIONS



Power Display LED
Is illuminated when power is ON. The power ON/OFF is controlled by the power switch of the IC-701. This unit does not have a separate power switch.

Speaker
There is a 125 x 77 mm oval speaker built in. Use as the external speaker for the IC-701. The impedance is 8 ohms and the input power is 2 watts.

SPK INPUT Jack
Speaker input jack for connecting to EXT SPK jack of the IC-701, using the included speaker cord.

Fan Power Jack
Jack for cooling fan connection. 12V, approximately 100mA is available through this jack. For normal operation, a cooling fan is not necessary; however, it is recommended that an optional cooling fan be used for continuous transmission, such as for RTTY.

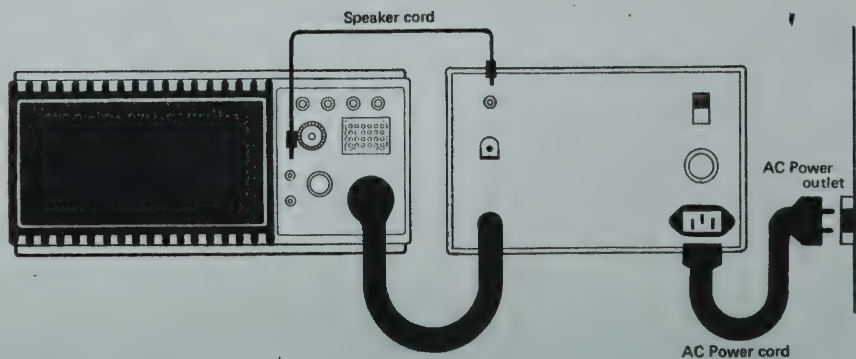
DC Output Plug
DC13.8V is available at up to 20A. Connect this plug to the power connector of the IC-701.

Main Switch
The power ON/OFF of this unit is remote-controlled by the power switch of the IC-701. The relay for this remote control is connected continuously to the AC power line and consumes 2VA. The power consumption of the relay is so little when the power switch is OFF that you need not worry about overheating. But it is recommended that the Main Switch be turned OFF when the unit is not used for a long time. When the Main Switch is OFF, the power can not be turned ON by the power switch of the IC-701.

Fuse Holder
Fuse holder for the AC power line. If the fuse blows, replace with a 5A (at 117V) or 3A (at 230V) fuse after checking the cause of the problem. Use a philips (+) screwdriver to open the holder. The outside ring of the holder can not be rotated.

AC Power Connector
Connect the included AC power cord.

GND Terminal
Ground this terminal with as short a wire as possible to protect from shock.



● **HOW TO USE THE INTERNAL SPEAKER**

Use the included speaker cord to connect the SPK INPUT jack on the rear panel of the IC-701PS and the EXT SPK jack on the rear panel of the IC-701.

The impedance and nominal input power of the speaker in this unit are 8 ohms and 2 watts, respectively, and this speaker can be used with any transceiver with these specifications. This speaker is designed for communication purposes and is not suitable for Hi-Fi use.

circuit is extremely simple, yet provides essentially the same performance as the MC1496.*

To begin installation, it is first necessary to remove Drake parts CR2, CR3, C83, C84, and R60. Next, the wires connecting the output of T11 and the printed circuit board are removed. The 0.01 μF coupling capacitor to be installed should connect between the transformer pins and the IC socket. There shouldn't be any connections on the circuit board for either the BFO of i-f inputs. Completing the installation only requires that the IC, socket, and associated components be mounted on a small piece of 100-mil Vector board and mounted in the same location as the MC1496 version. All other connections can be made according to **fig. 1**.

Audio output is slightly higher than a stock R-4C. The combination of R61 and the original 0.05 μF bypass capacitor provide the proper high-frequency rolloff. In this configuration, and also in the original, the product detector will accept a 20 dB increase in signal level before it overloads.

As an addendum, several people have reported an audio oscillation problem after incorporating the 0.0015 μF capacitor referred to in the original article. We've found that this can be cured by inserting a 4700-ohm resistor in series with the added capacitor and also connecting a 0.01 μF capacitor across the headphone jack.

reference

1. J. Robert Sherwood, WB0JGP and George B. Heidelman, K8RRH, "Present-Day Receivers — Some Problems and Cures," *ham radio*, December, 1977, page 10.

Rob Sherwood, WB0JGP
George Heidelman, K8RRH
Sherwood Engineering

preprogramming the Kenwood TR7500

A Kenwood TR7500 was recently obtained for mobile usage, and has proven excellent for that purpose. It became apparent, however, that dialing up the commonly used frequencies could be, for this operator at least, hazardous while driving because of the need to watch the frequency read-out dial while changing channels.

Users of the TR7500 should be aware that the transceiver has forty-four preprogrammed channels — all ARRL band-plan frequencies between 146 and 148 MHz, including all repeaters, and simplex frequencies. However, the transceiver also offers six blank channels, which are designed to be user programmed, by use of a diode matrix, for frequencies not included in the preprogrammed sequence. These frequencies must be on standard 30 kHz centers. Complete instructions for programming these additional channels, are in the transceiver operating manual.

The thought occurred to me that regular channels could also be programmed into the blank channels, rather than having to dial them out in the regular sequence. A review of the circuit and the programming instructions lead to a simple exercise in binary numbering, and a *complete* programming table was worked out. With this information, the six blank channels were quickly programmed.

The plan has worked out very nicely. The six channels are programmed for three repeaters, and three simplex frequencies, which completely handles local driving requirements. While driving, a quick glance identifies which of the six channels the radio is set on, with subsequent changes made by feel. Of course, any of the other regular channels is immediately available, simply by dialing up the appropriate channel in the normal manner.

Table 1 shows the complete diode programming instruction for all channels from 146.16 MHz to 147.99 MHz. Note that the columns are headed by designators P1 through P6, as used in the diode programming instructions of the operating manual.

Bob Locher, W9KNI

Table 1. Diode programming information for the TR7500.

frequency	P1	P2	P3	P4	P5	P6
146.16	0	0	0	0	0	0
146.19	1	0	0	0	0	0
146.22	0	1	0	0	0	0
146.25	1	1	0	0	0	0
146.28	0	0	1	0	0	0
146.31	1	0	1	0	0	0
146.34	0	1	1	0	0	0
146.37	1	1	1	0	0	0
146.40	0	0	0	1	0	0
146.43	1	0	0	1	0	0
146.46	0	1	0	1	0	0
146.49	1	1	0	1	0	0
146.52	0	0	1	1	0	0
146.55	1	0	1	1	0	0
146.58	0	1	1	1	0	0
146.61	1	1	1	1	0	0
146.64	0	0	0	0	1	0
146.67	1	0	0	0	1	0
146.70	0	1	0	0	1	0
146.73	1	1	0	0	1	0
146.76	0	0	1	0	1	0
146.79	1	0	1	0	1	0
146.82	0	1	1	0	1	0
146.85	1	1	1	0	1	0
146.88	0	0	0	1	1	0
146.91	1	0	0	1	1	0
146.94	0	1	0	1	1	0
146.97	1	1	0	1	1	0
147.00	0	0	1	1	1	0
147.03	1	0	1	1	1	0
147.06	0	1	1	1	1	0
147.09	1	1	1	1	1	0
147.12	0	0	0	0	0	1
147.15	1	0	0	0	0	1
147.18	0	1	0	0	0	1
147.21	1	1	0	0	0	1
147.24	0	0	1	0	0	1
147.27	1	0	1	0	0	1
147.30	0	1	1	0	0	1
147.33	1	1	1	0	0	1
147.36	0	0	0	1	0	1
147.39	1	0	0	1	0	1
147.42	0	1	0	1	0	1
147.45	1	1	0	1	0	1
147.48	0	0	1	1	0	1
147.51	1	0	1	1	0	1
147.54	0	1	1	1	0	1
147.57	1	1	1	1	0	1
147.60	0	0	0	0	1	1
147.63	1	0	0	0	1	1
147.66	0	1	0	0	1	1
147.69	1	1	0	0	1	1
147.72	0	0	1	0	1	1
147.75	1	0	1	0	1	1
147.78	0	1	1	0	1	1
147.81	1	1	1	0	1	1
147.84	0	0	0	1	1	1
147.87	1	0	0	1	1	1
147.90	0	1	0	1	1	1
147.93	1	1	0	1	1	1
147.96	0	0	1	1	1	1
147.99	1	0	1	1	1	1

Thank you for choosing the IC-701PS. This unit is an AC Power Supply for the IC-701, ICOM's Digital All Solid State HF Transceiver.

SPECIFICATIONS

• **Number of Semi-conductors:**	Silicon diode	4
	LED	1
• **Input Voltage (suitable voltage):**	117/230V AC (50/60 Hz)	
• **Allowable voltage fluctuation:**	±10% of input voltage (suitable line voltage)	
• **Input Capacity:**	360VA (at 20A load)	
• **Output Voltage:**	DC13.8V (at 20A load)	
• **Max. Load Current:**	20A (10 minutes ON/10 minutes OFF 50% duty cycle)	
• **Polarization:**	Negative ground	
• **Internal Speaker:**	125 x 77 mm 2 watt nominal input 4 watt maximum	
• **Dimensions:**	110 (H) x 180 (W) x 260 (D) mm	
• **Weight:**	Approximately 8 kg	
• **Accessories included:**	AC power cord	1
	Spare fuse	2
	Speaker cord	1

BEFORE USE

This is an AC power supply for the IC-701 and is designed to be turned ON and OFF with the power switch on your IC-701; this unit does not have a separate power switch.

As this unit has 20A maximum capacity at 13.8V DC, it is recommended that you do not use this unit with other than the IC-701, even for experimental purposes.

HOW TO USE

Connect the DC output plug of this unit to the IC-701 power connector securely, as shown in the figure at right. At this time, make sure that

(1) the power switch on the IC-701 is OFF,

(2) the T/R switch is at the RECEIVE position, and

(3) no microphone is connected.

Connect the AC power cord to the AC power connector on the rear panel of the IC-701PS. Connect the AC power cord plug in the power outlet. At this time, the remote control relay in this unit will be at the stand-by position. By turning the IC-701 power switch ON, this unit will be turned ON and the power display LED illuminated. For further operating information, see the instruction manual for the IC-701.

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Jack for cooling fan connection. 12V, approximately 100mA is available through this jack. For normal operation, a cooling fan is not necessary; however, it is recommended that an optional cooling fan be used for continuous transmission, such as for RTTY.

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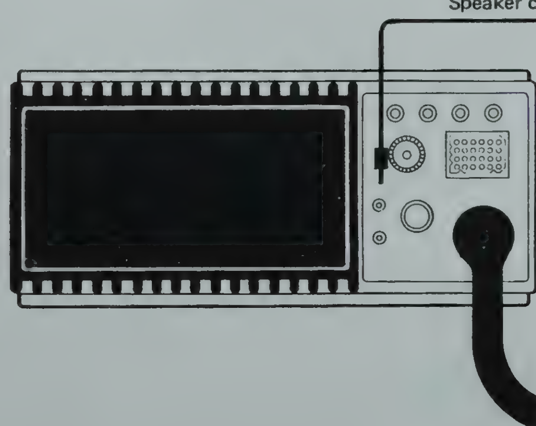
DC13.8V is available at up to 20A. Connect this plug to the power connector of the IC-701.



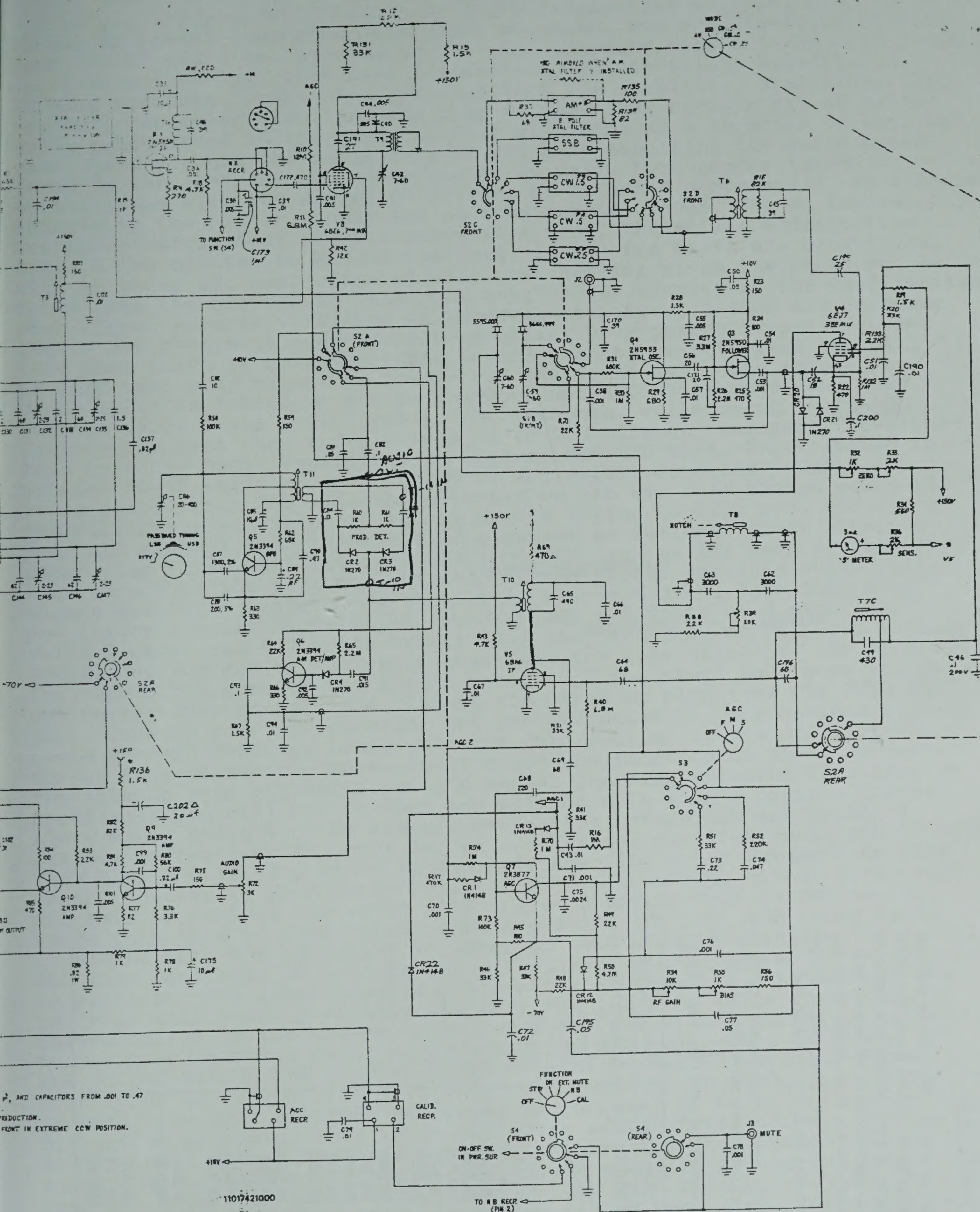


Figure 5–3. Schematic Diagram

PRODUCT DETECTOR
MOD (SEE NOTE)

BIRDIES

Some frequencies may be difficu
program-in one of these, the Scann
noise. These "birdies" are the prod
mixing with external signals like T
antennas are much more likely to
that is another good reason for ge
antenna for home installations.

If the interference is not severe, y
to cut out such annoying birdies.

A few of the most common birdies

Low Band	FM Broadcast
30.030 MHz	94.900 MHz
~	95.100
30.090	95.300
31.990	96.100
~	~
32.010	97.700
32.070	
~	
32.150	
35.800	
~	
35.855	
36.800	
~	
36.900	
38.395	
38.400	
38.405	
42.600	
~	
42.895	
44.790	
~	
44.810	
45.575	
~	
45.605	
46.310	
~	
46.415	
48.675	
48.795	

If you are presently running a Drake transmitter or transceiver with no linear or speech compressor/processor attached, and are dissatisfied with your "thin" audio as compared to what the imported rigs deliver with their built-in processing, then this information will certainly benefit you. In many respects, Drake rigs are excellent i.e stability, dial linearity, readout, receiving etc., however they do lack that certain bit of extra audio punch found in the imports. This will come as a surprise to you, but your Drake rig has the capability of not only equalling the audio punch found in the imports, but exceeding it as well. Furthermore it can be accomplished with the use of no linear, no outboard compression, no circuit changes in the rig or supply and no tube substitutions.* Sounds impossible, but nevertheless test results prove it's true. The entire modification takes a few minutes to do and the cost, if the two parts are bought new, will be under $2. Most often it will cost nothing since the parts can be taken from the proverbial "ham junk box." After completing the modification, your signal reports will show an improvement between 3-10db and remember that a 3db change is equivalent to doubling your power. Even if you are told that there is no appreciable S-unit change, nevertheless you will be told that your signal is louder and easier to copy. The reason why Drake audio is "thin" is due to overabundant ALC which cuts down your average voice peaks considerably. For instance, while using my TR-4C, despite the fact that I could tune up to 500 mils at resonance, nevertheless my voice peaks registered no higher than 180 mils. This equated to between 10-15 watts as seen on the W4 wattmeter. With the lowered ALC, voice peaks reach 250 mils and 40 watts on the W4. This change makes all the difference in the world to the person trying to copy you. You lower your ALC without changing the time constant as follows: first obtain a phono plug which will fit into the XMTG AGC jack on the back of your AC4. Make sure that the plug has a tight fitting ground envelope which will engage the outer diameter of that small elevated jack. Into this plug you solder a zener diode rated from between 4-6 volts at 1 watt. The value I chose was 4.7 volts but it will vary from rig to rig upon experimentation. One end of the zener goes into the male sleeve of the plug and the BANDED END goes to the ground portion of the plug. Make sure you do not reverse the connections. Insert the wired up plug into the XMTG AGC jack. Tune up your rig as usual but pay attention to your maximum keydown plate current reading. Leave your mic gain setting at the position where, during tune up, further advancement causes no increase in plate current. Now talk up your rig while using a normal speaking voice(no whistling or shouting). You will notice that you will be able to now cause a greater plate meter deflection on average peaks than before. We are trying to achieve deflections to equal 50% of our keydown plate current, AND NO MORE THAN THAT AMOUNT. The zener should hold down the meter movement to that amount however if your peaks register higher than 50%, either lower your mic gain or replace the zener with one at a higher voltage rating. Reverse this step if your voice peaks are still too low. The zener diode is placed into the circuitry to lower the ALC without changing the actual ALC time constant. It acts to cut off excessive grid current flow in order to maintain your final amplifier linearity at class AB_1. I doubt if any two rigs will reactly exactly the same for the same value diode, so experimentation is the answer. Just remember that we are trying to achieve higher average voice peaks conservatively, not radically. On peaks, DO NOT EXCEED 50% OF THE KEYDOWN PLATE CURRENT OR USE AN OUTBOARD SPEECH COMPRESSOR IN CONJUNCTION WITH THIS MODIFICATION. If either suggestion is ignored, you will splatter and cause an increase in third order harmonic distortion products. This is in violation of the latest F.C.C. rulings dealing with proper harmonic suppression! Lastly, the lowered ALC will cause a heat buildup in your finals. Place a muffin fan in the exhaust position atop your final cage. It will keep your finals fresh for years. I will bear no responsibility to anyone either receiving a citation or damaging his rig due to misuse of this mod. Furthermore, the R.L.Drake Co. will void the warranty of any new rig found to be defective due to such misuse.

*DO NOT USE ANY AMPLIFIED MIC WITH THIS MOD.

Hope it works OK, Harry

If you are presently running a Drake transmitter or transceiver with no speech compressor/processor attached, and are dissatisfied with "thin" audio as compared to what the imported rigs deliver with their built-in processing, then this information will certainly benefit you. In many respects, Drake rigs are excellent i.e stability, dial linearity, selection, receiving, etc., however they do lack that certain bit of extra audio punch found in the imports. This will come as a surprise to you, but your Drake rig has the capability of not only equalling the audio punch found in the imports, but exceeding it as well. Furthermore it can be accomplished with the use of no linear, no outboard compression, no circuit changes in the rig or supply and no tube substitutions! Sounds impossible, but nevertheless test results prove it's true. The entire modification takes a few minutes to do and the cost, if the two parts are bought new, will be under $2. Most often it will cost nothing since the parts can be taken from the proverbial "ham junk box." After completing the modification, your signal reports will show an improvement between 3-10db and remember that a 3db change is equivalent to doubling your power. Even if you are told that there is no appreciable S-unit change, nevertheless you will be told that your signal is louder and easier to copy. The reason why Drake audio is "thin" is due to overabundant ALC which cuts down your average voice peaks considerably. For instance, while using my TR-4C despite the fact that I could tune up to 600 mils at resonance, nevertheless my voice peaks registered no higher than 150 mils. This equated to between 10-15 watts as seen on the W4 wattmeter. With the lowered ALC, voice peaks reach 250 mils and 90 watts on the W4. This change makes all the difference in the world to the person trying to copy you. You lower your ALC without changing the time constant as follows: first obtain a phono plug which will fit into the XCTG ALC jack on the back of your AC4. Make sure that the plug has a tight fitting ground envelope which will engage the outer diameter of that small elevated jack. Into this plug you solder a zener diode rated from between 4-8 volts at 1 watt. The value I chose was 4.2 volts but it will vary from rig to rig upon experimentation. One end of the zener goes into the male sleeve of the plug and the BANDED END goes to the ground portion of the plug. Make sure you do not reverse the connections. Insert the wired up plug into the XCTG ALC jack. Tune up your rig as usual but pay attention to your maximum keydown plate current reading. Leave your mic gain setting at the position where, during tune up, further advancement causes no increase in plate current. Now talk up your rig while using a normal speaking voice (no whistling or shouting). You will notice that you will be able to now cause a greater plate meter deflection on average peaks than before. We are trying to achieve deflections to equal 80% of our keydown plate current, AND NO MORE THAN THAT AMOUNT. The zener should hold down the meter movement to that amount however if your peaks register greater than 80%, either lower your mic gain or replace the zener with one of a higher wattage rating. Reverse this step if your voice peaks are too low. The zener diode is placed into the circuitry to lower the ALC without changing the actual ALC time constant; it acts to cut off excessive grid current flow. In order to maintain your final amplifier linearity at close as I doubt if any two rigs will react exactly the same for the same value diodes so experimentation is the answer. Just remember that we are trying to achieve higher average voice peaks conservatively, not radically. On peaks, DO NOT EXCEED 80% OF YOUR KEYDOWN PLATE CURRENT OR USE AN OUTBOARD SPEECH COMPRESSOR IN CONJUNCTION WITH THIS MODIFICATION! If either suggestion is ignored, you will splatter and cause an increase in third order intermodulation products. This is in violation of the latest F.C.C. rulings dealing with proper harmonic suppression! Lastly, the lowered ALC will cause a heat buildup in your finals. Place a muffin fan in the exhaust position atop your final cage. It will keep your finals fresh for years. I will bear no responsibility to anyone either receiving a citation or damaging his rig due to misuse of this mod. Furthermore, the R.L. Drake Co. will void the warranty of any new rig found to be defective due to such misuse.